

# NASA Scientific and Technical Publications

*A Catalog  
of  
Special Publications,  
Reference Publications,  
Conference Publications, and  
Technical Papers*

1987

(NASA-SP-7063(02)) NASA SCIENTIFIC AND  
TECHNICAL PUBLICATIONS: A CATALOG OF SPECIAL  
PUBLICATIONS, REFERENCE PUBLICATIONS,  
CONFERENCE PUBLICATIONS, AND TECHNICAL  
PAPERS, 1987 (NASA) 69 p

N88-22830

Unclas  
CSCL 05B G1/82 0141579

NASA SP-7063(02)

# NASA Scientific and Technical Publications

*A Catalog  
of  
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Scientific and Technical Information Division 1988  
National Aeronautics and Space Administration  
Washington, DC

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# PREFACE

The pursuit of human knowledge through scientific research and technical endeavor has vastly expanded understanding of our world and the universe we live in. The contributions of NASA through scientific and technical research and development affect not only our understanding and use of aeronautics and space but also touch our daily lives. Geologists, oceanographers, meteorologists, archeologists, aircraft engineers, aerospace decision makers, land-use planners, historians, and rescue teams all make use of the results of NASA's research. The findings of this research and development are published in NASA's scientific and technical report series as a part of NASA's mandate to disseminate the results of the agency's far-reaching work.

This catalog provides a list of NASA publications from four report series entered into the NASA scientific and technical information database during accession year 1987. *Records of Achievement*, NASA SP-470 (accession number N83-33792) and *NASA Scientific and Technical Publications: A Catalog of Special Publications, Reference Publications, Conference Publications, and Technical Papers, 1977-1986*, NASA SP-7063(01) (accession number N87-30218) list previous NASA publications not covered by this catalog. Two semimonthly abstract journals cover all aspects of aeronautics and space research, NASA and non-NASA, nationally and worldwide: *STAR (Scientific and Technical Aerospace Reports)*, which focuses on scientific and technical reports, and *IAA (International Aerospace Abstracts)*, which covers the open literature. These are available by subscription from, respectively, the U.S. Government Printing Office and the American Institute of Aeronautics and Astronautics, Inc., (see below).

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*Special Publications* are often concerned with subjects of substantial public interest. They report scientific and technical information derived from NASA programs for audiences of diverse technical backgrounds.

*Reference Publications* contain compilations of scientific and technical data of continuing reference value.

*Conference Publications* record the proceedings of scientific and technical symposia and other professional meetings sponsored or cosponsored by NASA.

*Technical Papers* present the results of significant research conducted by NASA scientists and engineers.

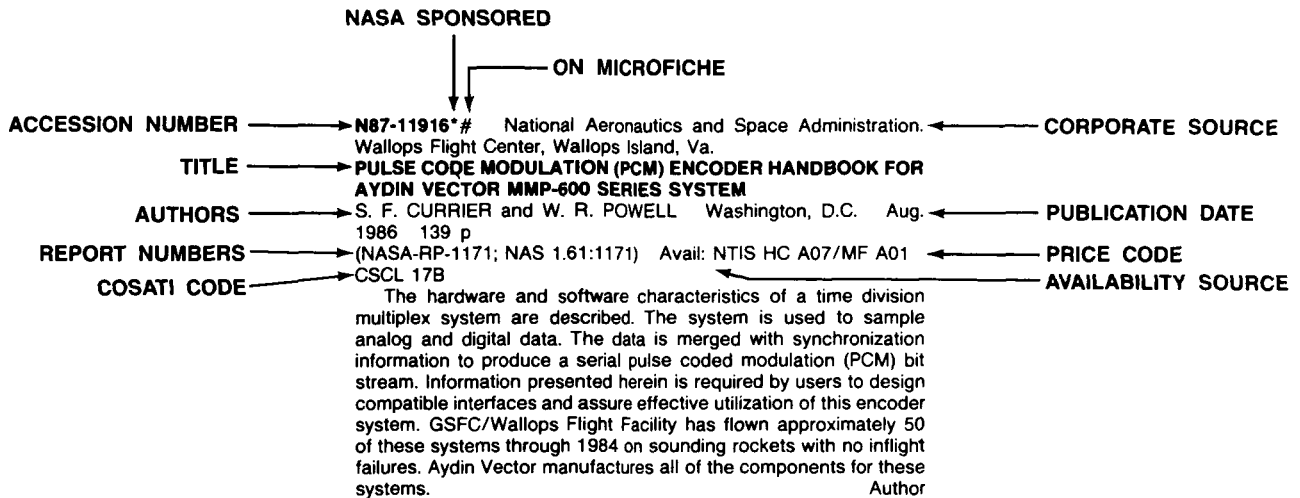
Presented here are citations for reports from each of these series. An explanation of the elements in a typical citation follows. Accession numbers (N numbers) at the end of a citation are separate citations to articles within the report. Please use *STAR* to locate these citations. Also note that some bibliographies in the NASA SP-7000 series are issued periodically. This catalog lists only the last accessioned report in each bibliography series. The periodicity of each bibliography is as follows:

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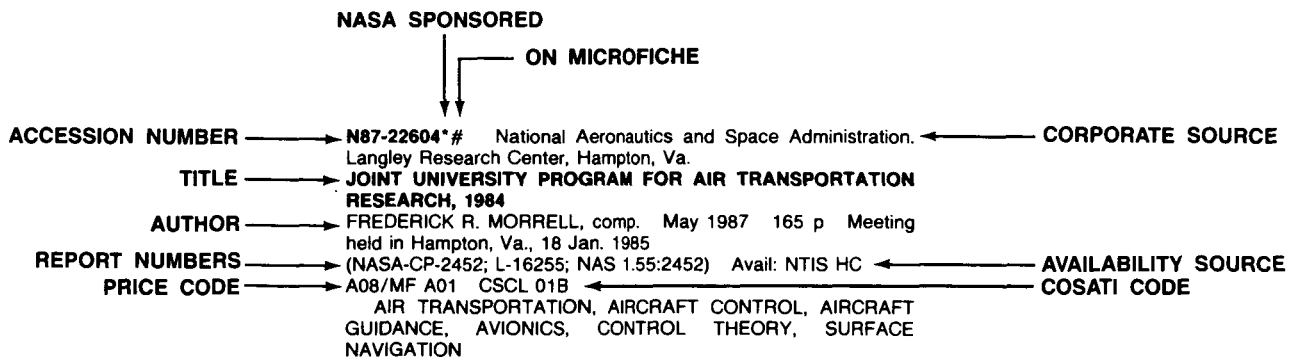
NASA SP-7046	<i>Technology for Large Space Systems: A Bibliography with Indexes</i>	Semiannual
NASA SP-7056	<i>Space Station Systems: A Bibliography with Indexes</i>	Semiannual
NASA SP-7500	<i>Management: A Bibliography for NASA Managers</i>	Annual

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## TYPICAL CITATION AND SUBJECT TERMS



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### 02 AERODYNAMICS 1

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also 34 *Fluid Mechanics and Heat Transfer*

### 03 AIR TRANSPORTATION AND SAFETY 5

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also 16 *Space Transportation* and 85 *Urban Technology and Transportation*.

### 04 AIRCRAFT COMMUNICATIONS AND NAVIGATION N.A.

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also 17 *Space Communications*, *Spacecraft Communications*, *Command and Tracking* and 32 *Communications and Radar*.

### 05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE 5

Includes aircraft simulation technology.

For related information see also 18 *Spacecraft Design, Testing and Performance* and 39 *Structural Mechanics*. For land transportation vehicles see 85 *Urban Technology and Transportation*.

### 06 AIRCRAFT INSTRUMENTATION 7

Includes cockpit and cabin display devices; and flight instruments.

For related information see also 19 *Spacecraft Instrumentation* and 35 *Instrumentation and Photography*.

### 07 AIRCRAFT PROPULSION AND POWER 7

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft.

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Includes aircraft handling qualities; piloting; flight controls; and autopilots.

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## ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; space communications, spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

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### 13 ASTRODYNAMICS N.A.

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For related information see also 03 *Air Transportation and Safety* and 18 *Spacecraft Design, Testing and Performance*. For space suits see 54 *Man/System Technology and Life Support*.

### 17 SPACE COMMUNICATIONS, SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING N.A.

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For related information see also 04 *Aircraft Communications and Navigation* and 32 *Communications and Radar*.

**18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE 10**

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and attitude controls.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance*, *39 Structural Mechanics*, and *16 Space Transportation*.

**19 SPACECRAFT INSTRUMENTATION N.A.**

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**20 SPACECRAFT PROPULSION AND POWER 10**

Includes main propulsion systems and components, e.g. rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion and Power*, *28 Propellants and Fuels*, *44 Energy Production and Conversion*, and *15 Launch Vehicles and Space Vehicles*.

**CHEMISTRY AND MATERIALS**

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; propellants and fuels; and materials processing.

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For composite materials see *24 Composite Materials*.

**28 PROPELLANTS AND FUELS N.A.**

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For related information see also *07 Aircraft Propulsion and Power*, *20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.

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**ENGINEERING**

Includes engineering (general); communications and radar; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

For related information see also *Physics*.

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## **GEOSCIENCES**

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## **LIFE SCIENCES**

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### **53 BEHAVIORAL SCIENCES N.A.**

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### **54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT N.A.**

Includes human engineering; biotechnology; and space suits and protective clothing.

For related information see also *16 Space Transportation*.

### **55 SPACE BIOLOGY N.A.**

Includes exobiology; planetary biology; and extraterrestrial life.

## **MATHEMATICAL AND COMPUTER SCIENCES**

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

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### **62 COMPUTER SYSTEMS 22**

Includes computer networks and special application computer systems.

### **63 CYBERNETICS N.A.**

Includes feedback and control theory, artificial intelligence, robotics and expert systems.

For related information see also *54 Man/System Technology and Life Support*.

### **64 NUMERICAL ANALYSIS 22**

Includes iteration, difference equations, and numerical approximation.

### **65 STATISTICS AND PROBABILITY 23**

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

### **66 SYSTEMS ANALYSIS N.A.**

Includes mathematical modeling; network analysis; and operations research.

### **67 THEORETICAL MATHEMATICS N.A.**

Includes topology and number theory.

## **PHYSICS**

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy physics; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.

For related information see also *Engineering*.

### **70 PHYSICS (GENERAL) N.A.**

For precision time and time interval (PTTI) see *35 Instrumentation and Photography*; for geophysics, astrophysics or solar physics see *46 Geophysics*, *90 Astrophysics*, or *92 Solar Physics*.

- 71 ACOUSTICS** **23**  
Includes sound generation, transmission, and attenuation.  
For noise pollution see *45 Environment Pollution*.
- 72 ATOMIC AND MOLECULAR PHYSICS** **N.A.**  
Includes atomic structure, electron properties, and molecular spectra.
- 73 NUCLEAR AND HIGH-ENERGY PHYSICS** **24**  
Includes elementary and nuclear particles; and reactor theory.  
For space radiation see *93 Space Radiation*.
- 74 OPTICS** **24**  
Includes light phenomena and optical devices.  
For lasers see *36 Lasers and Masers*.
- 75 PLASMA PHYSICS** **24**  
Includes magnetohydrodynamics and plasma fusion.  
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.
- 76 SOLID-STATE PHYSICS** **N.A.**  
Includes superconductivity.  
For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.
- 77 THERMODYNAMICS AND STATISTICAL PHYSICS** **N.A.**  
Includes quantum mechanics; theoretical physics; and Bose and Fermi statistics.  
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.
- SOCIAL SCIENCES**  
Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law, political science, and space policy; and urban technology and transportation.
- 80 SOCIAL SCIENCES (GENERAL)** **N.A.**  
Includes educational matters.
- 81 ADMINISTRATION AND MANAGEMENT** **24**  
Includes management planning and research.
- 82 DOCUMENTATION AND INFORMATION SCIENCE** **24**  
Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography.  
For computer documentation see *61 Computer Programming and Software*.
- 83 ECONOMICS AND COST ANALYSIS** **N.A.**  
Includes cost effectiveness studies.

- 84 LAW, POLITICAL SCIENCE AND SPACE POLICY** **N.A.**  
Includes NASA appropriation hearings; aviation law; space law and policy; international law; international cooperation; and patent policy.
- 85 URBAN TECHNOLOGY AND TRANSPORTATION** **25**  
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.  
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.
- SPACE SCIENCES**  
Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.  
For related information see also *Geosciences*.
- 88 SPACE SCIENCES (GENERAL)** **25**
- 89 ASTRONOMY** **25**  
Includes radio, gamma-ray, and infrared astronomy; and astrometry.
- 90 ASTROPHYSICS** **26**  
Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.  
For related information see also *75 Plasma Physics*.
- 91 LUNAR AND PLANETARY EXPLORATION** **26**  
Includes planetology; and manned and unmanned flights.  
For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance*.
- 92 SOLAR PHYSICS** **26**  
Includes solar activity, solar flares, solar radiation and sunspots.  
For related information see *93 Space Radiation*.
- 93 SPACE RADIATION** **27**  
Includes cosmic radiation; and inner and outer earth's radiation belts.  
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.
- GENERAL**  
Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs.
- 99 GENERAL** **27**

Note: N.A. means that no abstracts were assigned to this category for this issue.

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REPORT NUMBER INDEX .....	C-1

## 01

### AERONAUTICS (GENERAL)

**N87-18520\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.  
**JOINT UNIVERSITY PROGRAM FOR AIR TRANSPORTATION RESEARCH, 1983**

FREDERICK R. MORRELL, comp. Mar. 1987 80 p Conference held in Atlantic City, N.J., 16 Dec. 1983; sponsored by NASA and FAA  
 (NASA-CP-2451; L-16254; NAS 1.55:2451) Avail: NTIS HC A05/MF A01 CSCL 01B

AIR NAVIGATION, AIR TRANSPORTATION, AIRCRAFT GUIDANCE, AVIONICS, CONFERENCES, FLIGHT CONTROL

**N87-22604\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.  
**JOINT UNIVERSITY PROGRAM FOR AIR TRANSPORTATION RESEARCH, 1984**

FREDERICK R. MORRELL, comp. May 1987 165 p Meeting held in Hampton, Va., 18 Jan. 1985  
 (NASA-CP-2452; L-16255; NAS 1.55:2452) Avail: NTIS HC A08/MF A01 CSCL 01B

AIR TRANSPORTATION, AIRCRAFT CONTROL, AIRCRAFT GUIDANCE, AVIONICS, CONTROL THEORY, SURFACE NAVIGATION

**N87-25267\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**WIND SHEAR/TURBULENCE INPUTS TO FLIGHT SIMULATION AND SYSTEMS CERTIFICATION**

ROLAND L. BOWLES, ed. and WALTER FROST, ed. (FWG Associates, Inc., Tullahoma, Tenn.) Jul. 1987 272 p Workshop held in Hampton, Va., 30 May - 1 Jun. 1984  
 (NASA-CP-2474; L-16329; NAS 1.55:2474) Avail: NTIS HC A12/MF A01 CSCL 01B

AIRCRAFT PERFORMANCE, AVIONICS, FLIGHT SAFETY, FLIGHT SIMULATION, PILOT PERFORMANCE, WIND SHEAR

**N87-27596\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**JOINT UNIVERSITY PROGRAM FOR AIR TRANSPORTATION RESEARCH, 1985**

FREDERICK R. MORRELL, comp. Jul. 1987 100 p Conference held in Atlantic City, N.J., 30 Jan. 1986  
 (NASA 1.55:2453; NASA-CP-2453) Avail: NTIS HC A05/MF A01 CSCL 01B

AIR TRAFFIC CONTROL, AIR TRANSPORTATION, CONFERENCES, FAULT TOLERANCE, FLIGHT CONTROL, GLOBAL POSITIONING SYSTEM, INERTIAL NAVIGATION

**N87-27613\*** National Aeronautics and Space Administration, Washington, D.C.

**AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 217)**

Sep. 1987 134 p  
 (NASA-SP-7037(217); NAS 1.21:7037(217)) Avail: NTIS HC A07 CSCL 01B

This bibliography lists 450 reports, articles, and other documents introduced into the NASA scientific and technical information system in August, 1987. Author

## 02

### AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

**N87-10039\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**WIND-TUNNEL INVESTIGATION OF THE FLIGHT CHARACTERISTICS OF A CANARD GENERAL-AVIATION AIRPLANE CONFIGURATION**

D. R. SATRAN Oct. 1986 60 p  
 (NASA-TP-2623; L-15929; NAS 1.60:2623) Avail: NTIS HC A04/MF A01 CSCL 01A

CANARD CONFIGURATIONS, FLIGHT CHARACTERISTICS, GENERAL AVIATION AIRCRAFT, WIND TUNNEL TESTS

**N87-10042\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**SUPERSONIC, NONLINEAR, ATTACHED-FLOW WING DESIGN FOR HIGH LIFT WITH EXPERIMENTAL VALIDATION**

J. L. PITTMAN, D. S. MILLER, and W. H. MASON (Grumman Aerospace Corp., Bethpage, N.Y.) Aug. 1984 221 p  
 (NASA-TP-2336; L-15787; NAS 1.60:2336) Avail: NTIS HC A10/MF A01 CSCL 01A

CAMBERED WINGS, REATTACHED FLOW, SUPERCRITICAL FLOW, SUPERSONIC AIRFOILS, SUPERSONIC FLOW

**N87-10838\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**EFFECTS OF TAIL SPAN AND EMPENNAGE ARRANGEMENT ON DRAG OF A TYPICAL SINGLE-ENGINE FIGHTER AFT END**

J. R. BURLEY, II and B. L. BERRIER Sep. 1984 136 p  
 (NASA-TP-2352; L-15742; NAS 1.60:2352) Avail: NTIS HC A07/MF A01 CSCL 01A

AERODYNAMIC DRAG, AIRCRAFT CONFIGURATIONS, SKIN FRICTION, TAIL ASSEMBLIES, TRANSONIC SPEED

## 02 AERODYNAMICS

**N87-10839\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**STATIC INTERNAL PERFORMANCE OF SINGLE-EXPANSION-RAMP NOZZLES WITH THRUST-VECTORING CAPABILITY UP TO 60 DEG**

B. L. BERRIER and L. D. LEAVITT Oct. 1984 144 p  
(NASA-TP-2364; L-15766; NAS 1.60:2364) Avail: NTIS HC  
A07/MF A01 CSCL 01A

AXISYMMETRIC BODIES, NOZZLE FLOW, THRUST VECTOR CONTROL

**N87-10841\*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**TRANSONIC FLOW ANALYSIS FOR ROTORS. PART 2: THREE-DIMENSIONAL, UNSTEADY, FULL-POTENTIAL CALCULATION**

I. C. CHANG Jan. 1985 27 p  
(NASA-TP-2375-PT-2; A-9682; NAS 1.60:2375-PT-2) Avail: NTIS  
HC A03/MF A01 CSCL 01A

AERODYNAMIC STABILITY, HELICOPTER PERFORMANCE, ROTORS, TIP VANES, TRANSONIC FLOW

**N87-10843\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**PILOTED SIMULATION STUDY OF THE EFFECTS OF AN AUTOMATED TRIM SYSTEM ON FLIGHT CHARACTERISTICS OF A LIGHT TWIN-ENGINE AIRPLANE WITH ONE ENGINE INOPERATIVE**

E. C. STEWART, P. W. BROWN, and K. R. YENNI Nov. 1986 41 p  
(NASA-TP-2633; L-16147; NAS 1.60:2633) Avail: NTIS HC  
A03/MF A01 CSCL 01A

AERODYNAMIC BALANCE, AUTOMATIC FLIGHT CONTROL, ENGINE FAILURE, LIGHT AIRCRAFT

**N87-11702\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**FORWARD-SWEPT WING CONFIGURATION DESIGNED FOR HIGH MANEUVERABILITY BY USE OF A TRANSONIC COMPUTATIONAL METHOD**

M. J. MANN and C. E. MERCER Nov. 1986 185 p  
(NASA-TP-2628; L-16120; NAS 1.60:2628) Avail: NTIS HC  
A09/MF A01 CSCL 01A

AERODYNAMIC CONFIGURATIONS, HIGHLY MANEUVERABLE AIRCRAFT, SWEPT FORWARD WINGS, TRANSONIC SPEED

**N87-12541\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**EFFECT OF PORT CORNER GEOMETRY ON THE INTERNAL PERFORMANCE OF A ROTATING-VANE-TYPE THRUST REVERSER**

B. L. BERRIER and F. J. CAPONE Dec. 1986 51 p  
(NASA-TP-2624; L-16135; NAS 1.60:2624) Avail: NTIS HC  
A04/MF A01 CSCL 01A

CORNER FLOW, NOZZLE GEOMETRY, PORTS (OPENINGS), ROTATING BODIES, THRUST REVERSAL, VANES, WIND TUNNEL TESTS

**N87-14284\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**PROPAGATION OF SOUND WAVES IN TUBES OF NONCIRCULAR CROSS SECTION**

W. B. RICHARDS (Oberlin Coll., Ohio) Aug. 1986 33 p  
(NASA-TP-2601; E-2690; NAS 1.60:2601) Avail: NTIS HC  
A03/MF A01 CSCL 01A

ELLIPTICAL CYLINDERS, PIPES (TUBES), SOUND WAVES, WAVE PROPAGATION

**N87-15174\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**APPLICABILITY OF LINEARIZED-THEORY ATTACHED-FLOW METHODS TO DESIGN AND ANALYSIS OF FLAP SYSTEMS AT LOW SPEEDS FOR THIN SWEPT WINGS WITH SHARP LEADING EDGES**

HARRY W. CARLSON and CHRISTINE M. DARDEN Jan. 1987 54 p

(NASA-TP-2653; L-16151; NAS 1.60:2653) Avail: NTIS HC  
A04/MF A01 CSCL 01A

DESIGN ANALYSIS, FLAPS (CONTROL SURFACES), LINEARITY, LOW SPEED, SHARP LEADING EDGES, SWEPT WINGS, THIN WINGS, VORTEX FLAPS

**N87-15183\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**EFFICIENT SOLUTIONS TO THE EULER EQUATIONS FOR SUPERSONIC FLOW WITH EMBEDDED SUBSONIC REGIONS**

ROBERT W. WALTERS and DOUGLAS L. DWOYER Jan. 1987 18 p

(NASA-TP-2523; L-15975; NAS 1.60:2523) Avail: NTIS HC  
A02/MF A01 CSCL 01A

EMBEDDING, EULER EQUATIONS OF MOTION, PROBLEM SOLVING, SUBSONIC FLOW, SUPERSONIC FLOW

**N87-15184\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**SUBSONIC MANEUVER CAPABILITY OF A SUPERSONIC CRUISE FIGHTER WING CONCEPT**

GREGORY D. RIEBE and CHARLES H. FOX, JR. Jan. 1987 74 p

(NASA-TP-2642; L-16097; NAS 1.60:2642) Avail: NTIS HC  
A04/MF A01 CSCL 01A

FIGHTER AIRCRAFT, MANEUVERS, SUBSONIC SPEED, SUPERSONIC CRUISE AIRCRAFT RESEARCH, WINGS

**N87-17665\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**PRELIMINARY DESIGN OF TURBOPUMPS AND RELATED MACHINERY**

GEORGE F. WISLICENUS Oct. 1986 397 p  
(NAS3-13475)

(NASA-RP-1170; E-7389; NAS 1.61:1170) Avail: NTIS HC  
A17/MF A01 CSCL 01A

Pumps used in large liquid-fuel rocket engines are examined. The term preliminary design denotes the initial, creative phases of design, where the general shape and characteristics of the machine are determined. This compendium is intended to provide the design engineer responsible for these initial phases with a physical understanding and background knowledge of the numerous special fields involved in the design process. Primary attention is directed to the pumping part of the turbopump and hence is concerned with essentially incompressible fluids. However, compressible flow principles are developed. As much as possible, the simplicity and reliability of incompressible flow considerations are retained by treating the mechanics of compressible fluids as a departure from the theory of incompressible fluids. Five areas are discussed: a survey of the field of turbomachinery in dimensionless form; the theoretical principles of the hydrodynamic design of turbomachinery; the hydrodynamic and gas dynamic design of axial flow turbomachinery; the hydrodynamic and gas dynamic design of radial and mixed flow turbomachinery; and some mechanical design considerations of turbomachinery. Theoretical considerations are presented with a relatively elementary mathematical treatment. Author

**N87-17668\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**WIND-TUNNEL INVESTIGATION AT SUPERSONIC SPEEDS OF A REMOTE-CONTROLLED CANARD MISSILE WITH A FREE-ROLLING-TAIL BRAKE TORQUE SYSTEM**

A. B. BLAIR, JR. Mar. 1985 38 p  
(NASA-TP-2401; L-15882; NAS 1.60:2401) Avail: NTIS HC A03/MF A01 CSCL 01A

BRAKING, CANARD CONFIGURATIONS, FINS, MISSILE CONFIGURATIONS, REMOTE CONTROL, ROLLING MOMENTS, SUPERSONIC SPEED, TAIL ASSEMBLIES, TORQUE, WIND TUNNEL TESTS

**N87-17669\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**COMBINED AERODYNAMIC AND STRUCTURAL DYNAMIC PROBLEM EMULATING ROUTINES (CASPER): THEORY AND IMPLEMENTATION**

WILLIAM H. JONES Feb. 1985 75 p  
(NASA-TP-2418; E-2278; NAS 1.60:2418) Avail: NTIS HC A04/MF A01 CSCL 01A

AERODYNAMIC COEFFICIENTS, COMPUTATIONAL FLUID DYNAMICS, COMPUTERIZED SIMULATION, DYNAMIC STRUCTURAL ANALYSIS

**N87-18537\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**HELICOPTER BLADE-VORTEX INTERACTION LOCATIONS: SCALE-MODEL ACOUSTICS AND FREE-WAKE ANALYSIS RESULTS**

DANNY R. HOAD Apr. 1987 106 p  
(DA PROJ. 1L1-62209-AH-76-A)  
(NASA-TP-2658; L-16214; AVSCOM-TM-87-B-1; NAS 1.60:2658) Avail: NTIS HC A06/MF A01 CSCL 01A

ACOUSTICS, BLADE-VORTEX INTERACTION, FREE FLOW, HELICOPTERS, ROTORS, VORTICES, WAKES

**N87-19351\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**NUMERICAL SIMULATION OF CHANNEL FLOW TRANSITION, RESOLUTION REQUIREMENTS AND STRUCTURE OF THE HAIRPIN VORTEX**

STEVEN E. KRIST (Joint Inst. for Advancement of Flight Sciences, Hampton, Va.) and THOMAS A. ZANG Apr. 1987 71 p  
(NASA-TP-2667; L-16204; NAS 1.60:2667) Avail: NTIS HC A04/MF A01 CSCL 01A

BOUNDARY LAYER STABILITY, BOUNDARY LAYER TRANSITION, BOUNDARY VALUE PROBLEMS, CHANNEL FLOW, COMPUTATIONAL FLUID DYNAMICS, SPECTRAL METHODS

**N87-20233\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**INVESTIGATION OF LEADING-EDGE FLAP PERFORMANCE ON DELTA AND DOUBLE-DELTA WINGS AT SUPERSONIC SPEEDS**

PETER F. COVELL, RICHARD M. WOOD, and DAVID S. MILLER Apr. 1987 125 p  
(NASA-TP-2656; L-16143; NAS 1.60:2656) Avail: NTIS HC A06/MF A01 CSCL 01A

DELTA WINGS, EXPERIMENT DESIGN, LEADING EDGE FLAPS, SUPERSONIC SPEED

**N87-20238\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**LEWIS INVERSE DESIGN CODE (LINDES): USERS MANUAL**

JOSE M. SANZ Mar. 1987 67 p  
(NASA-TP-2676; E-3221; NAS 1.60:2676) Avail: NTIS HC A04/MF A01 CSCL 01A

AIRFOILS, CODING, DESIGN ANALYSIS, HODOGRAPHS, INVERSIONS, TURBINE BLADES, USER MANUALS (COMPUTER PROGRAMS)

**N87-20966\*#** National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.

**IN-FLIGHT SURFACE OIL-FLOW PHOTOGRAPHS WITH COMPARISONS TO PRESSURE DISTRIBUTION AND BOUNDARY-LAYER DATA**

ROBERT R. MEYER, JR. and LISA A. JENNETT Apr. 1985 27 p Original contains color illustrations  
(NASA-TP-2395; H-1184; NAS 1.60:2395) Avail: NTIS HC A03/MF A01 CSCL 01A

BOUNDARY LAYER FLOW, FLOW VISUALIZATION, IN-FLIGHT MONITORING, OILS, PHOTOGRAPHY, PRESSURE DISTRIBUTION

**N87-21855\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**WIND-TUNNEL FREE-FLIGHT INVESTIGATION OF A 0.15-SCALE MODEL OF THE F-106B AIRPLANE WITH VORTEX FLAPS**

LONG P. YIP May 1987 46 p  
(NASA-TP-2700; L-16202; NAS 1.60:2700) Avail: NTIS HC A03/MF A01 CSCL 01A

F-106 AIRCRAFT, FREE FLIGHT, VORTEX FLAPS, WIND TUNNEL MODELS, WIND TUNNEL TESTS

**N87-21871\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**NEW METHODS AND RESULTS FOR QUANTIFICATION OF LIGHTNING-AIRCRAFT ELECTRODYNAMICS**

FELIX L. PITTS, LARRY D. LEE, RODNEY A. PERALA, and TERENCE H. RUDOLPH (Electro Magnetic Applications, Inc., Lakewood, Colo.) Jun. 1987 67 p  
(NASA-TP-2737; L-16281; NAS 1.60:2737) Avail: NTIS HC A04/MF A01 CSCL 01A

ELECTRODYNAMICS, F-106 AIRCRAFT, FLIGHT TESTS, LIGHTNING, RESEARCH AIRCRAFT

**N87-21873\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**EFFECTS OF AFTERBODY BOATTAIL DESIGN AND EMPENNAGE ARRANGEMENT ON AEROPROPULSIVE CHARACTERISTICS OF A TWIN-ENGINE FIGHTER MODEL AT TRANS-SONIC SPEEDS**

LINDA S. BANGERT, LAURENCE D. LEAVITT, and DAVID E. REUBUSH Jun. 1987 134 p  
(NASA-TP-2704; L-16227; NAS 1.60:2704) Avail: NTIS HC A07/MF A01 CSCL 01A

AFTERBODIES, AXISYMMETRIC FLOW, BOATTAILS, DRAG, FIGHTER AIRCRAFT, NOZZLES, PROPULSIVE EFFICIENCY, TAIL ASSEMBLIES

**N87-22626\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**EXPERIMENTAL CAVITY PRESSURE DISTRIBUTIONS AT SUPERSONIC SPEEDS**

ROBERT L. STALLINGS, JR. and FLOYD J. WILCOX, JR. Jun. 1987 79 p  
(NASA-TP-2683; L-16215; NAS 1.60:2683) Avail: NTIS HC A05/MF A01 CSCL 01A

CAVITIES, FLUID FLOW, PRESSURE DISTRIBUTION, SUPERSONIC SPEED

**N87-23586\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**ON MINIMIZING THE NUMBER OF CALCULATIONS IN DESIGN-BY-ANALYSIS CODES**

RAYMOND L. BARGER and ANUTOSH MOITRA Jun. 1987 16 p  
(NASA-TP-2706; L-16226; NAS 1.60:2706) Avail: NTIS HC A02/MF A01 CSCL 01A

AERODYNAMIC CONFIGURATIONS, APPROXIMATION, DESIGN ANALYSIS, NUMERICAL ANALYSIS, PRESSURE DISTRIBUTION



## 02 AERODYNAMICS

**N87-23592\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**MACH 6 EXPERIMENTAL AND THEORETICAL STABILITY AND PERFORMANCE OF A CRUCIFORM MISSILE AT ANGLES OF ATTACK UP TO 65 DEGREES**

EDWARD R. HARTMAN (Arnold Engineering Development Center, Arnold Air Force Station, Tenn.) and PATRICK J. JOHNSTON Jul. 1987 41 p

(NASA-TP-2733; L-16287; NAS 1.60:2733) Avail: NTIS HC A03/MF A01 CSCL 01A

ANGLE OF ATTACK, CRUCIFORM WINGS, EXPERIMENTATION, HYPERSONIC SPEED, MACH NUMBER, MISSILES

**N87-23593\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**EFFECT OF A TRADE BETWEEN BOATTAIL ANGLE AND WEDGE SIZE ON THE PERFORMANCE OF A NONAXISYMMETRIC WEDGE NOZZLE**

GEORGE T. CARSON, JR., E. ANN BARE, and JAMES R. BURLEY, II Jul. 1987 67 p

(NASA-TP-2717; L-16248; NAS 1.60:2717) Avail: NTIS HC A04/MF A01 CSCL 01A

AXISYMMETRIC BODIES, BOATTAILS, NOZZLE GEOMETRY, PERFORMANCE TESTS, TRADEOFFS, WEDGES

**N87-23597\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**STUDY OF LEE-SIDE FLOWS OVER CONICALLY CAMBERED DELTA WINGS AT SUPERSONIC SPEEDS, PART 1**

RICHARD M. WOOD and CAROLYN B. WATSON Jul. 1987 212 p

(NASA-TP-2660-PT-1; L-16192; NAS 1.60:2660-PT-1) Avail: NTIS HC A10/MF A01 CSCL 01A

CONICAL CAMBER, DELTA WINGS, FLOW DISTRIBUTION, LEE WAVES, STRUCTURAL DESIGN, SUPERSONIC FLOW, VORTICES

**N87-24410\*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**PROCEEDINGS OF THE 1985 NASA AMES RESEARCH CENTER'S GROUND-EFFECTS WORKSHOP**

KERRY MITCHELL, ed. Feb. 1987 448 p Workshop held at Moffett Field, Calif., 20-21 Aug. 1985

(NASA-CP-2462; A-86391; NAS 1.55:2462) Avail: NTIS HC A19/MF A01 CSCL 01A

GROUND EFFECT (AERODYNAMICS), INGESTION (ENGINES), POWERED LIFT AIRCRAFT, V/STOL AIRCRAFT, VERTICAL LANDING

**N87-24432\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**STATIC INTERNAL PERFORMANCE OF A TWO-DIMENSIONAL CONVERGENT-DIVERGENT NOZZLE WITH THRUST VECTORING**

E. ANN BARE and DAVID E. REUBUSH Jul. 1987 115 p

(NASA-TP-2721; L-16240; NAS 1.60:2721) Avail: NTIS HC A06/MF A01 CSCL 01A

CONVERGENT-DIVERGENT NOZZLES, STATIC TESTS, THRUST VECTOR CONTROL, TWO DIMENSIONAL FLOW

**N87-24433\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**MULTIAXIS CONTROL POWER FROM THRUST VECTORING FOR A SUPERSONIC FIGHTER AIRCRAFT MODEL AT MACH 0.20 TO 2.47**

FRANCIS J. CAPONE and E. ANN BARE Jul. 1987 264 p

(NASA-TP-2712; L-16213; NAS 1.60:2712) Avail: NTIS HC A12/MF A01 CSCL 01A

FIGHTER AIRCRAFT, MACH NUMBER, SUPERSONIC CRUISE AIRCRAFT RESEARCH, THRUST VECTOR CONTROL

**N87-25301\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**STUDY OF LEE-SIDE FLOWS OVER CONICALLY CAMBERED DELTA WINGS AT SUPERSONIC SPEEDS, PART 2**

RICHARD M. WOOD and CAROLYN B. WATSON Jul. 1987 404 p

(NASA-TP-2660-PT-2; L-16192; NAS 1.60:2660-PT-2) Avail: NTIS HC A18/MF A01 CSCL 01A

CONICAL CAMBER, DELTA WINGS, FLOW DISTRIBUTION, FLOW VISUALIZATION, SUPERSONIC FLOW, WING LOADING

**N87-25998\*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**SUPERCOMPUTING IN AEROSPACE**

PAUL KUTLER and HELEN YEE Mar. 1987 299 p Symposium held at Moffett Field, Calif., 10-12 Mar. 1987

(NASA-CP-2454; A-87082; NAS 1.55:2454) Avail: NTIS HC A13/MF A01 CSCL 01A

COMPUTATIONAL ASTROPHYSICS, COMPUTATIONAL CHEMISTRY, COMPUTATIONAL FLUID DYNAMICS, COMPUTATIONAL GRIDS, COMPUTERIZED SIMULATION, CONFERENCES, INTERACTIONAL AERODYNAMICS, NAVIER-STOKES EQUATION, SUPERCOMPUTERS

**N87-26031\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**EFFECT OF REYNOLDS NUMBER VARIATION ON AERODYNAMICS OF A HYDROGEN-FUELED TRANSPORT CONCEPT AT MACH 6**

JIM A. PENLAND and DON C. MARCUM, JR. Aug. 1987 28 p

(NASA-TP-2728; L-16286; NAS 1.60:2728) Avail: NTIS HC A03/MF A01 CSCL 01A

AERODYNAMIC CONFIGURATIONS, HYDROGEN FUELS, HYPERSONIC AIRCRAFT, MACH NUMBER, REYNOLDS NUMBER, TRANSPORT AIRCRAFT

**N87-26032\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**STEADY AND UNSTEADY AERODYNAMIC FORCES FROM THE SOUSSA SURFACE-PANEL METHOD FOR A FIGHTER WING WITH TIP MISSILE AND COMPARISON WITH EXPERIMENT AND PANAIR**

HERBERT J. CUNNINGHAM Aug. 1987 29 p

(NASA-TP-2736; L-16262; NAS 1.60:2736) Avail: NTIS HC A03/MF A01 CSCL 01A

AERODYNAMIC FORCES, FIGHTER AIRCRAFT, PANEL METHOD (FLUID DYNAMICS), UNSTEADY FLOW, WINGS

**N87-26874\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**SUBSONIC LONGITUDINAL AND LATERAL-DIRECTIONAL CHARACTERISTICS OF A FORWARD-SWEPT-WING FIGHTER CONFIGURATION AT ANGLES OF ATTACK UP TO 47 DEG**

MICHAEL J. MANN, JARRETT K. HUFFMAN, and CHARLES H. FOX, JR. Sep. 1987 103 p

(NASA-TP-2727; L-16206; NAS 1.60:2727) Avail: NTIS HC A06/MF A01 CSCL 01A

AERODYNAMIC CONFIGURATIONS, ANGLE OF ATTACK, FIGHTER AIRCRAFT, LATERAL CONTROL, LATERAL STABILITY, SUBSONIC AIRCRAFT, SWEEPED FORWARD WINGS

**N87-26883\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**AN EXPERIMENTAL INVESTIGATION OF AN ADVANCED TURBOPROP INSTALLATION ON A SWEEPED WING AT SUBSONIC AND TRANSONIC SPEEDS**

JOHN R. CARLSON and ODIS C. PENDERGRAFT, JR. Sep. 1987 242 p

(NASA-TP-2729; L-16043; NAS 1.60:2729) Avail: NTIS HC A11/MF A01 CSCL 01A

AERODYNAMICS, ENGINE AIRFRAME INTEGRATION, SUBSONIC SPEED, SWEEPED WINGS, TRANSONIC SPEED, TURBOPROP ENGINES

**N87-27622\*#** National Aeronautics and Space Administration.  
Langley Research Center, Hampton, Va.

**CALCULATION OF VISCOUS EFFECTS ON TRANSONIC FLOW FOR OSCILLATING AIRFOILS AND COMPARISONS WITH EXPERIMENT**

JAMES T. HOWLETT and SAMUEL R. BLAND Sep. 1987  
77 p

(NASA-TP-2731; L-16289; NAS 1.60:2731) Avail: NTIS HC

A05/MF A01 CSCL 01A

AIRFOILS, COMPARISON, INVISCID FLOW, OSCILLATIONS, TRANSONIC FLOW, VISCOUS FLOW

**N87-27626\*#** National Aeronautics and Space Administration.  
Langley Research Center, Hampton, Va.

**DRAW MEASUREMENTS OF BLUNT STORES TANGENTIALLY MOUNTED ON A FLAT PLATE AT SUPERSONIC SPEEDS**

FLOYD J. WILCOX, JR. Sep. 1987 68 p

(NASA-TP-2742; L-16284; NAS 1.60:2742) Avail: NTIS HC

A04/MF A01 CSCL 01A

AERODYNAMIC DRAW, BLUNT BODIES, EXTERNAL STORES, FLAT PLATES, MOUNTING, SUPERSONIC SPEED, TANGENTS

**N87-27643\*#** National Aeronautics and Space Administration.  
Langley Research Center, Hampton, Va.

**PRESSURE MEASUREMENTS ON A THICK CAMBERED AND TWISTED 58 DEG DELTA WING AT HIGH SUBSONIC SPEEDS**

JULIO CHU and JOHN E. LAMAR Sep. 1987 233 p

(NASA-TP-2713; L-16224; NAS 1.60:2713) Avail: NTIS HC

A11/MF A01 CSCL 01A

CAMBER, DELTA WINGS, PRESSURE MEASUREMENT, SUBSONIC SPEED, THICKNESS, TWISTED WINGS

**N87-29432\*#** National Aeronautics and Space Administration.  
Ames Research Center, Moffett Field, Calif.

**AUTOMATED REDUCTION OF DATA FROM IMAGES AND HOLOGRAMS**

G. LEE, ed., JAMES D. TROLINGER, ed. (Spectron Development Labs., Inc., Costa Mesa, Calif.), and Y. H. YU, ed. May 1987  
614 p Workshop held at Moffett Field, Calif., 10-11 Jan. 1985

(NASA-CP-2477; A-87135; NAS 1.55:2477) Avail: NTIS HC

A99/MF A01 CSCL 01A

COMBUSTIBLE FLOW, DIGITAL TECHNIQUES, HOLOGRAPHIC INTERFEROMETRY, IMAGE ANALYSIS, PARTICLE SIZE DISTRIBUTION

**N87-29462\*#** National Aeronautics and Space Administration.  
Langley Research Center, Hampton, Va.

**LOW-SPEED AERODYNAMIC CHARACTERISTICS OF A TWIN-ENGINE GENERAL AVIATION CONFIGURATION WITH AFT-FUSELAGE-MOUNTED PUSHER PROPELLERS**

DANA MORRIS DUNHAM, GARL L. GENTRY, JR., GREGORY S. MANUEL, ZACHARY T. APPLIN, and P. FRANK QUINTO Oct. 1987 116 p

(NASA-TP-2763; L-16331; NAS 1.60:2763) Avail: NTIS HC

A06/MF A01 CSCL 01A

AERODYNAMIC CHARACTERISTICS, GENERAL AVIATION AIRCRAFT, LOW SPEED, PROPELLERS, PROPULSION SYSTEM CONFIGURATIONS, PYLON MOUNTING, TURBOPROP ENGINES

## 03

## AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

**N87-10054\*#** National Aeronautics and Space Administration.  
Langley Research Center, Hampton, Va.

**DOPPLER RADAR DETECTION OF WIND SHEAR**

V. E. DELNORE, Comp. (PRC Kentron, Inc., Hampton, Va.) and V. A. MCCLELLAN (Research Triangle Inst., Research Triangle Park, N.C.) Sep. 1985 118 p Presented at a Meeting, Hampton, Va., 24-25 Sep., 1985; sponsored in part by FAA

(NASA-CP-2435; NAS 1.55:2435; FAA/PM-86/31) Avail: NTIS

HC A06/MF A01 CSCL 01C

AIRCRAFT HAZARDS, CONFERENCES, DOPPLER RADAR, MICROBURSTS, RADAR MEASUREMENT, WIND SHEAR

**N87-22634\*#** National Aeronautics and Space Administration.  
Ames Research Center, Moffett Field, Calif.

**COCKPIT RESOURCE MANAGEMENT TRAINING**

HARRY W. ORLADY, ed. (Orlady Associates, Inc., Los Gatos, Calif.) and H. CLAYTON FOUSHEE, ed. May 1987 308 p Workshop held in San Francisco, Calif., 6-8 May 1986; sponsored by NASA. Ames Research Center and Air Force Military Airlift

(NASA-CP-2455; A-87038; NAS 1.55:2455) Avail: NTIS HC

A14/MF A01 CSCL 01C

FLIGHT CREWS, FLIGHT SIMULATION, FLIGHT TRAINING, GROUP DYNAMICS, PERSONNEL MANAGEMENT

**N87-29469\*#** National Aeronautics and Space Administration.  
Langley Research Center, Hampton, Va.

**JET TRANSPORT FLIGHT OPERATIONS USING COCKPIT DISPLAY OF TRAFFIC INFORMATION DURING INSTRUMENT METEOROLOGICAL CONDITIONS: SIMULATION EVALUATION**

DAVID H. WILLIAMS and DOUGLAS C. WELLS May 1986  
50 p

(NASA-TP-2567; L-16091; NAS 1.60:2567) Avail: NTIS HC

A03/MF A01 CSCL 01C

AIR TRAFFIC CONTROL, COCKPIT SIMULATORS, DISPLAY DEVICES, INSTRUMENT APPROACH, JET AIRCRAFT, TRANSPORT AIRCRAFT, VIDEO COMMUNICATION, WORKLOADS (PSYCHOPHYSIOLOGY)

## 05

## AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

**N87-11717\*#** National Aeronautics and Space Administration.  
Langley Research Center, Hampton, Va.

**RECENT EXPERIENCES IN MULTIDISCIPLINARY ANALYSIS AND OPTIMIZATION, PART 1**

J. SOBIESKI, comp. 1984 517 p Symposium held in Hampton, Va., 24-26 Apr. 1984

(NASA-CP-2327-PT-1; NAS 1.55:2327-PT-1) Avail: NTIS HC

A22/MF A01 CSCL 01C

AIRCRAFT DESIGN, COMPUTER AIDED DESIGN, CONFERENCES, DESIGN ANALYSIS, OPTIMIZATION, STRUCTURAL DESIGN

**N87-11750\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.  
**RECENT EXPERIENCES IN MULTIDISCIPLINARY ANALYSIS AND OPTIMIZATION, PART 2**  
 J. SOBIESKI, comp. 1984 509 p Symposium held in Hampton, Va., 24-26 Apr. 1984  
 (NASA-CP-2327-PT-2; L-15830; NAS 1.55:2327-PT-2) Avail: NTIS HC A22/MF A01 CSCL 01C  
 AIRCRAFT DESIGN, COMPUTER AIDED DESIGN, HELICOPTERS, OPTIMIZATION

**N87-15959\*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.  
**LARGE-SCALE STATIC INVESTIGATION OF CIRCULATION-CONTROL-WING CONCEPTS APPLIED TO UPPER SURFACE-BLOWING AIRCRAFT**  
 M. D. SHOVLIN, R. J. ENGLAR (Naval Ship Research and Development Center, Bethesda, Md.), J. C. EPEL, and J. H. NICHOLS, JR. Jan. 1987 65 p  
 (NASA-TP-2684; NAS 1.60:2684) Avail: NTIS HC A04/MF A01 CSCL 01C  
 CIRCULATION CONTROL AIRFOILS, GROUND TESTS, LIFT AUGMENTATION, SHORT TAKEOFF AIRCRAFT, STATIC TESTS, THRUST CONTROL, TURBOFAN ENGINES, UPPER SURFACE BLOWING

**N87-16815\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.  
**FLIGHT INVESTIGATION OF THE EFFECT OF TAIL CONFIGURATION ON STALL, SPIN, AND RECOVERY CHARACTERISTICS OF A LOW-WING GENERAL AVIATION RESEARCH AIRPLANE**  
 H. PAUL STOUGH, III, JAMES M. PATTON, JR., and STEVEN M. SLIWA Feb. 1987 125 p  
 (NASA-TP-2644; L-16194; NAS 1.60:2644) Avail: NTIS HC A06/MF A01 CSCL 01C  
 AERODYNAMIC CONFIGURATIONS, AERODYNAMIC STALLING, AIRCRAFT SPIN, GENERAL AVIATION AIRCRAFT, RESEARCH AIRCRAFT, TAIL ASSEMBLIES

**N87-17690\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.  
**EXPLOITING SYMMETRIES IN THE MODELING AND ANALYSIS OF TIRES**  
 AHMED K. NOOR (Joint Inst. for Advancement of Flight Sciences, Hampton, Va.), CARL M. ANDERSEN (College of William and Mary, Hampton, Va.), and JOHN A. TANNER Mar. 1987 63 p (NCC1-40)  
 (NASA-TP-2649; L-16185; NAS 1.60:2649) Avail: NTIS HC A04/MF A01 CSCL 01C  
 FINITE ELEMENT METHOD, MATHEMATICAL MODELS, SYMMETRY, TIRES

**N87-17693\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.  
**EFFECTS OF EMPENNAGE SURFACE LOCATION ON AERODYNAMIC CHARACTERISTICS OF A TWIN-ENGINE AFTERBODY MODEL WITH NONAXISYMMETRIC NOZZLES**  
 FRANCIS J. CAPONE and GEORGE T. CARSON, JR. Feb. 1985 79 p  
 (NASA-TP-2392; L-15825; NAS 1.60:2392) Avail: NTIS HC A05/MF A01 CSCL 01C  
 AERODYNAMIC CHARACTERISTICS, AERODYNAMIC DRAG, AFTERBODIES, AXISYMMETRIC BODIES, FIGHTER AIRCRAFT, NOZZLE GEOMETRY, TAIL ASSEMBLIES, TAIL SURFACES

**N87-20990\*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.  
**SUMMARY OF STUDIES TO REDUCE WING-MOUNTED PROPFAN INSTALLATION DRAG ON AN M = 0.8 TRANSPORT**  
 RONALD C. SMITH, ALAN D. LEVIN, and RICHARD D. WOOD May 1987 29 p  
 (NASA-TP-2678; A-86242; NAS 1.60:2678) Avail: NTIS HC A03/MF A01 CSCL 01C  
 DRAG REDUCTION, HIGH SPEED, PROP-FAN TECHNOLOGY, TRANSPORT AIRCRAFT, WIND TUNNEL TESTS

**N87-23614\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.  
**FLIGHT INVESTIGATION OF THE EFFECTS OF AN OUTBOARD WING-LEADING-EDGE MODIFICATION ON STALL/SPIN CHARACTERISTICS OF A LOW-WING, SINGLE-ENGINE, T-TAIL LIGHT AIRPLANE**  
 H. PAUL STOUGH, III, DANIEL J. DICARLO, and JAMES M. PATTON, JR. Jul. 1987 117 p  
 (NASA-TP-2691; L-16243; NAS 1.60:2691) Avail: NTIS HC A06/MF A01 CSCL 01A  
 AERODYNAMIC STALLING, FLIGHT TESTS, INVESTIGATION, LEADING EDGES, REVISIONS, SPIN, WINGS

**N87-24458\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.  
**MEASUREMENTS OF FLOW RATE AND TRAJECTORY OF AIRCRAFT TIRE-GENERATED WATER SPRAY**  
 ROBERT H. DAUGHERTY and SANDY M. STUBBS Jul. 1987 118 p  
 (NASA-TP-2718; L-16195; NAS 1.60:2718) Avail: NTIS HC A06/MF A01 CSCL 01C  
 AIRCRAFT TIRES, ENGINE INLETS, FLOW VELOCITY, INGESTION (ENGINES), SPLASHING, SPRAYING

**N87-26041\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.  
**EVALUATION OF INSTALLED PERFORMANCE OF A WING-TIP-MOUNTED PUSHER TURBOPROP ON A SEMISPAN WING**  
 JAMES C. PATTERSON, JR. and GLYNN R. BARTLETT Aug. 1987 30 p  
 (NASA-TP-2739; L-16252; NAS 1.60:2739) Avail: NTIS HC A03/MF A01 CSCL 01C  
 INSTALLING, PROPELLERS, SEMISPAN MODELS, TURBOFAN ENGINES, TURBOPROP ENGINES, WING TIP VORTICES

**N87-29497\*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.  
**QUALITATIVE EVALUATION OF A FLUSH AIR DATA SYSTEM AT TRANSONIC SPEEDS AND HIGH ANGLES OF ATTACK**  
 TERRY J. LARSON, STEPHEN A. WHITMORE, L. J. EHERNBERGER, J. BLAIR JOHNSON, and PAUL M. SIEMERS, III Washington NASA Apr. 1987 64 p  
 (NASA-TP-2716; H-1277; NAS 1.60:2716) Avail: NTIS HC A04/MF A01 CSCL 01C  
 AIR DATA SYSTEMS, ANGLE OF ATTACK, FLOW DISTRIBUTION, ORIFICE FLOW, PITOT TUBES, STAGNATION PRESSURE, TRANSONIC SPEED

**N87-29499\*#** National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.  
**APPLICATION OF PARAMETER ESTIMATION TO AIRCRAFT STABILITY AND CONTROL: THE OUTPUT-ERROR APPROACH**  
 RICHARD E. MAINE and KENNETH W. ILIFF Jun. 1986 175 p Submitted for publication  
 (NASA-RP-1168; H-1299; NAS 1.61:1168) Avail: NTIS HC A08/MF A01 CSCL 01C  
 The practical application of parameter estimation methodology to the problem of estimating aircraft stability and control derivatives from flight test data is examined. The primary purpose of the

document is to present a comprehensive and unified picture of the entire parameter estimation process and its integration into a flight test program. The document concentrates on the output-error method to provide a focus for detailed examination and to allow us to give specific examples of situations that have arisen. The document first derives the aircraft equations of motion in a form suitable for application to estimation of stability and control derivatives. It then discusses the issues that arise in adapting the equations to the limitations of analysis programs, using a specific program for an example. The roles and issues relating to mass distribution data, preflight predictions, maneuver design, flight scheduling, instrumentation sensors, data acquisition systems, and data processing are then addressed. Finally, the document discusses evaluation and the use of the analysis results. Author

## 06

## AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

**N87-10864\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.  
**GROUND-BASED TIME-GUIDANCE ALGORITHM FOR CONTROL OF AIRPLANES IN A TIME-METERED AIR TRAFFIC CONTROL ENVIRONMENT: A PILOTED SIMULATION STUDY**  
 C. E. KNOX and N. IMBERT (Office National d'Etudes et de Recherches Aérospatiales, Toulouse, France) Nov. 1986 36 p (NASA-TP-2616; L-16116; NAS 1.60:2616) Avail: NTIS HC A03/MF A01 CSCL 01D

AIR TRAFFIC CONTROL, ENERGY CONSERVATION, FLIGHT MANAGEMENT SYSTEMS, FLIGHT SIMULATION, FUEL CONSUMPTION, PILOTS (PERSONNEL), TIMING DEVICES

**N87-13438\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.  
**DEVELOPMENT AND EVALUATION OF AN AIRPLANE ELECTRONIC DISPLAY FORMAT ALIGNED WITH THE INERTIAL VELOCITY VECTOR**  
 G. G. STEINMETZ Dec. 1986 23 p (NASA-TP-2648; L-16168; NAS 1.60:2648) Avail: NTIS HC A02/MF A01 CSCL 01D

ALIGNMENT, DIRECTIONAL CONTROL, DISPLAY DEVICES, ELECTRONIC EQUIPMENT, FLIGHT TESTS, INERTIAL NAVIGATION, PERFORMANCE TESTS, VELOCITY

**N87-19393\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.  
**A SIMULATION EVALUATION OF A PILOT INTERFACE WITH AN AUTOMATIC TERMINAL APPROACH SYSTEM**  
 DAVID A. HINTON Apr. 1987 21 p (NASA-TP-2669; L-16222; NAS 1.60:2669) Avail: NTIS HC A02/MF A01 CSCL 17G  
 APPROACH CONTROL, AUTOMATIC CONTROL, AUTOMATIC PILOTS, GENERAL AVIATION AIRCRAFT, MAN MACHINE SYSTEMS

**N87-29533\*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.  
**ANALOG SIGNAL CONDITIONING FOR FLIGHT-TEST INSTRUMENTATION**  
 DONALD W. VEATCH and RODNEY K. BOGUE Washington NASA Jan. 1986 173 p Presented at the AGARD Flight Mechanics Panel, Flight-test Techniques Working Group, AGARDograph 160, Flight-Test Instrumentation Series Previously announced as N86-29816 (NASA-RP-1159; H-1191; NAS 1.61:1159) Avail: NTIS HC A08/MF A01 CSCL 01D

The application of analog signal conditioning to flight-tests data acquisition systems is discussed. Emphasis is placed on practical

applications of signal conditioning for the most common flight-test data-acquisition systems. A limited amount of theoretical discussion is included to assist the reader in a more complete understanding of the subject matter. Nonspecific signal conditioning, such as amplification, filtering, and multiplexing, is discussed. Signal conditioning for various specific transducers and data terminal devices is also discussed to illustrate signal conditioning that is unique to particular types of transducers. The purpose is to delineate for the reader the various signal-conditioning technique options, together with tradeoff considerations, for commonly encountered flight-test situations. Author

## 07

## AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft.

**N87-17699\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.  
**DESIGN OF 9.271-PRESSURE-RATIO 5-STAGE CORE COMPRESSOR AND OVERALL PERFORMANCE FOR FIRST 3 STAGES**

RONALD J. STEINKE May 1986 35 p (NASA-TP-2597; E-2589; NAS 1.60:2597) Avail: NTIS HC A03/MF A01 CSCL 21E

COMPRESSORS, DESIGN ANALYSIS, FLOW DISTRIBUTION, PERFORMANCE TESTS, ROTOR BLADES (TURBOMACHINERY)

**N87-20267\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.  
**NASA-CHINESE AERONAUTICAL ESTABLISHMENT (CAE) SYMPOSIUM**  
 1986 230 p Symposium held in Cleveland, Ohio, 23-27 Sep. 1985 (NASA-CP-2433; E-3033; NAS 1.55:2433) Avail: NTIS HC A01/MF A01 CSCL 21E  
 COMBUSTION, FLUID DYNAMICS, THERMODYNAMICS

**N87-24481\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.  
**LOW-COST FM OSCILLATOR FOR CAPACITANCE TYPE OF BLADE TIP CLEARANCE MEASUREMENT SYSTEM**  
 JOHN P. BARRANGER Jul. 1987 16 p (NASA-TP-2746; E-3455; NAS 1.60:2746) Avail: NTIS HC A02/MF A01 CSCL 21E  
 BLADE TIPS, ERROR ANALYSIS, FREQUENCY MODULATION, NONDESTRUCTIVE TESTS, OSCILLATORS, ROTOR BLADES (TURBOMACHINERY)

## AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

**N87-10103\*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**IN-FLIGHT TOTAL FORCES, MOMENTS AND STATIC AEROELASTIC CHARACTERISTICS OF AN OBLIQUE-WING RESEARCH AIRPLANE**

R. E. CURRY and A. G. SIM Oct. 1984 30 p  
(NASA-TP-2224; H-1181; NAS 1.60:2224) Avail: NTIS HC A03/MF A01 CSCL 01C

AEROELASTIC RESEARCH WINGS, AIRCRAFT DESIGN, FLIGHT TESTS, OBLIQUE WINGS, RESEARCH AIRCRAFT, STRUCTURAL DESIGN, WIND TUNNEL TESTS

**N87-10870\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**INTERFERENCE EFFECTS OF THRUST REVERSING ON HORIZONTAL TAIL EFFECTIVENESS OF TWIN-ENGINE FIGHTER AIRCRAFT AT MACH NUMBERS FROM 0.15 TO 0.90**

F. J. CAPONE and M. L. MASON Oct. 1984 104 p  
(NASA-TP-2350; L-15811; NAS 1.60:2350) Avail: NTIS HC A06/MF A01 CSCL 01C

AERODYNAMIC INTERFERENCE, FIGHTER AIRCRAFT, TAIL ASSEMBLIES, THRUST REVERSAL, WIND TUNNEL TESTS

**N87-10871\*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**FLIGHT-DETERMINED AERODYNAMIC DERIVATIVES OF THE AD-1 OBLIQUE-WING RESEARCH AIRPLANE**

A. G. SIM and R. E. CURRY Oct. 1984 40 p  
(NASA-TP-2222; H-1179; NAS 1.60:2222) Avail: NTIS HC A03/MF A01 CSCL 01C

AERODYNAMIC COEFFICIENTS, OBLIQUE WINGS, RESEARCH AIRCRAFT, VARIABLE SWEEP WINGS

**N87-16849\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**PILOTTED SIMULATOR STUDY OF ALLOWABLE TIME DELAYS IN LARGE-AIRPLANE RESPONSE**

WILLIAM D. GRANTHAM, PAUL M. SMITH (PRC Kentron, Inc., Hampton, Va.), LEE H. PERSON, JR., ROBERT T. MEYER (Lockheed-Georgia Co., Marietta), and STEPHEN A. TINGAS Feb. 1987 69 p

(NASA-TP-2652; L-16149; NAS 1.60:2652) Avail: NTIS HC A04/MF A01 CSCL 01C

CONTROL SYSTEMS DESIGN, FLIGHT CHARACTERISTICS, FLIGHT SIMULATORS, LOW SPEED, TIME LAG, TRANSPORT AIRCRAFT

**N87-18570\*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**FLIGHT CHARACTERISTICS OF THE AD-1 OBLIQUE-WING RESEARCH AIRCRAFT**

ALEX G. SIM and ROBERT E. CURRY Mar. 1985 29 p  
(NASA-TP-2223; H-1180; NAS 1.60:2223) Avail: NTIS HC A03/MF A01 CSCL 01C

AERODYNAMIC CONFIGURATIONS, FLIGHT CHARACTERISTICS, LOW SPEED, OBLIQUE WINGS, RESEARCH AIRCRAFT

**N87-25331\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**ADVANCED DETECTION, ISOLATION AND ACCOMMODATION OF SENSOR FAILURES: REAL-TIME EVALUATION**

WALTER C. MERRILL, JOHN C. DELAAT, and WILLIAM M. BRUTON Jul. 1987 30 p  
(NASA-TP-2740; E-3479; NAS 1.60:2740) Avail: US Patent and Trademark Office CSCL 01C

ENGINE CONTROL, ENGINE FAILURE, FAULT TOLERANCE, REDUNDANCY ENCODING, REMOTE SENSORS, TURBINE ENGINES

**N87-26922\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**PILOTTED-SIMULATION STUDY OF EFFECTS OF VORTEX FLAPS ON LOW-SPEED HANDLING QUALITIES OF A DELTA-WING AIRPLANE**

JAY M. BRANDON, PHILIP W. BROWN, and ALFRED J. WUNSCHER Sep. 1987 38 p

(NASA-TP-2747; L-16307; NAS 1.60:2747) Avail: NTIS HC A03/MF A01 CSCL 01C

CONTROLLABILITY, DELTA WINGS, FLIGHT SIMULATION, LOW SPEED, PILOTS (PERSONNEL), VORTEX FLAPS

## 09

## RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands.

**N87-10876\*#** National Aeronautics and Space Administration. Washington, D.C.

**AERONAUTICAL FACILITIES ASSESSMENT**

F. E. PENARANDA, comp. Nov. 1985 204 p  
(NASA-RP-1146; NAS 1.61:1146) Avail: NTIS HC A10/MF A01 CSCL 14B

A survey of the free world's aeronautical facilities was undertaken and an evaluation made on where the relative strengths and weaknesses exist. Special emphasis is given to NASA's own capabilities and needs. The types of facilities surveyed are: Wind Tunnels; Airbreathing Propulsion Facilities; and Flight Simulators

Author

**N87-17717\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**EXPERIMENTAL EVALUATION OF WALL MACH NUMBER DISTRIBUTIONS OF THE OCTAGONAL TEST SECTION PROPOSED FOR NASA LEWIS RESEARCH CENTER'S ALTITUDE WIND TUNNEL**

DOUGLAS E. HARRINGTON, RICHARD R. BURLEY, and ROBERT R. CORBAN Nov. 1986 35 p

(NASA-TP-2666; E-3145; NAS 1.60:2666) Avail: NTIS HC A03/MF A01 CSCL 14B

FLOW VELOCITY, MACH NUMBER, WIND TUNNEL APPARATUS, WIND TUNNEL WALLS

**N87-18576\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**EXPERIMENTAL EVALUATION OF TWO TURNING VANE DESIGNS FOR FAN DRIVE CORNER OF 0.1-SCALE MODEL OF NASA LEWIS RESEARCH CENTER'S PROPOSED ALTITUDE WIND TUNNEL**

DONALD R. BOLDMAN, ROYCE D. MOORE, and RICKEY J. SHYNE Mar. 1987 148 p

(NASA-TP-2646; E-3175; NAS 1.60:2646) Avail: NTIS HC A07/MF A01 CSCL 14B

CORNER FLOW, VANES, WIND TUNNEL APPARATUS, WIND TUNNEL DRIVES

**N87-20295\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**DETAILED FLOW SURVEYS OF TURNING VANES DESIGNED FOR A 0.1-SCALE MODEL OF NASA LEWIS RESEARCH CENTER'S PROPOSED ALTITUDE WIND TUNNEL**

ROYCE D. MOORE, RICKEY J. SHYNE, DONALD R. BOLDMAN, and THOMAS F. GELDER Apr. 1987 151 p  
(NASA-TP-2680; E-3294; NAS 1.60:2680) Avail: NTIS HC A08/MF A01 CSCL 14B

ALTITUDE SIMULATION, FLOW DISTRIBUTION, GUIDE VANES, WIND TUNNEL APPARATUS, WIND TUNNEL DRIVES

**N87-22694\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**EXPERIMENTAL EVALUATION OF BLOCKAGE RATIO AND PLENUM EVACUATION SYSTEM FLOW EFFECTS ON PRESSURE DISTRIBUTION FOR BODIES OF REVOLUTION IN 0.1 SCALE MODEL TEST SECTION OF NASA LEWIS RESEARCH CENTER'S PROPOSED ALTITUDE WIND TUNNEL**

RICHARD R. BURLEY and DOUGLAS E. HARRINGTON Apr. 1987 26 p  
(NASA-TP-2702; E-3267; NAS 1.60:2702) Avail: NTIS HC A03/MF A01 CSCL 14B

EVACUATING (VACUUM), EVALUATION, PLENUM CHAMBERS, WIND TUNNEL MODELS, WIND TUNNEL TESTS

**N87-23662\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**EXPERIMENTAL EVALUATION OF HONEYCOMB/SCREEN CONFIGURATIONS AND SHORT CONTRACTION SECTION FOR NASA LEWIS RESEARCH CENTER'S ALTITUDE WIND TUNNEL**

RICHARD R. BURLEY and DOUGLAS E. HARRINGTON May 1987 30 p  
(NASA-TP-2692; E-3142; NAS 1.60:2692) Avail: NTIS HC A03/MF A01 CSCL 14B

HONEYCOMB STRUCTURES, PRESSURE DISTRIBUTION, SCREENS, TURBULENCE EFFECTS, TURBULENT FLOW, WIND TUNNEL CALIBRATION

**N87-28570\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**EVOLUTION, CALIBRATION, AND OPERATIONAL CHARACTERISTICS OF THE TWO-DIMENSIONAL TEST SECTION OF THE LANGLEY 0.3-METER TRANSONIC CRYOGENIC TUNNEL**

CHARLES L. LADSON and EDWARD J. RAY Sep. 1987 171 p  
(NASA-TP-2749; L-16190; NAS 1.60:2749) Avail: NTIS HC A08/MF A01 CSCL 14B

CRYOGENIC WIND TUNNELS, EVOLUTION (DEVELOPMENT), HISTORIES, TRANSONIC WIND TUNNELS, TWO DIMENSIONAL FLOW

**N87-29544\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**LANGLEY AIRCRAFT LANDING DYNAMICS FACILITY**

PAMELA A. DAVIS, SANDY M. STUBBS, and JOHN A. TANNER Oct. 1987 35 p  
(NASA-RP-1189; L-16293; NAS 1.61:1189) Avail: NTIS HC A03/MF A01 CSCL 14B

The Langley Research Center has recently upgraded the Landing Loads Track (LLT) to improve the capability of low-cost testing of conventional and advanced landing gear systems. The unique feature of the Langley Aircraft Landing Dynamics Facility (ALDF) is the ability to test aircraft landing gear systems on actual runway surfaces at operational ground speeds and loading conditions. A historical overview of the original LLT is given, followed by a detailed description of the new ALDF systems and operational capabilities. Author

## 12

## ASTRONAUTICS (GENERAL)

**N87-20302\*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**THE 1986 GET AWAY SPECIAL EXPERIMENTER'S SYMPOSIUM**

LAWRENCE R. THOMAS, ed. and FRANCES L. MOSIER, ed. Feb. 1987 236 p Symposium held in Greenbelt, Md., 7-8 Oct. 1986  
(NASA-CP-2438; NAS 1.55:2438) Avail: NTIS HC A11/MF A01 CSCL 22A

CONFERENCES, GETAWAY SPECIALS (STS), GOVERNMENT/INDUSTRY RELATIONS, SPACE SHUTTLE PAYLOADS, UNIVERSITIES

**N87-29576\*** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**TECHNOLOGY FOR LARGE SPACE SYSTEMS. A BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 17)**

Oct. 1987 140 p  
(NASA-SP-7046(17); NAS 1.21:7046(17)) Avail: NTIS HC A07 CSCL 22B

This bibliography lists 512 reports, articles, and other documents introduced into the NASA scientific and technical information system between January 1, 1987 and June 30, 1987. Its purpose is to provide helpful information to the researcher, manager, and designer in technology development and mission design according to system, interactive analysis and design, structural and thermal analysis and design, structural concepts and control systems, electronics, advanced materials, assembly concepts, propulsion, and solar power satellite systems. Author

## 15

## LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; operating problems of launch/space vehicle systems; and reusable vehicles.

**N87-12581\*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

**SOLAR ARRAY FLIGHT DYNAMIC EXPERIMENT**

R. W. SCHOCK Washington May 1986 27 p  
(NASA-TP-2598; NAS 1.60:2598) Avail: NTIS HC A03/MF A01 CSCL 10A

LARGE SPACE STRUCTURES, LASER APPLICATIONS, SOLAR ARRAYS, SPACE SHUTTLE PAYLOADS, TRACKING (POSITION)

**N87-18588\*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

**SYSTEM STUDY OF THE CARBON DIOXIDE OBSERVATIONAL PLATFORM SYSTEM (CO-OPS): PROJECT OVERVIEW**

J. BRISCOE STEPHENS and WILBUR E. THOMPSON Mar. 1987 35 p  
(NASA-TP-2696; NAS 1.60:2696) Avail: NTIS HC A03/MF A01 CSCL 22B

ATMOSPHERIC COMPOSITION, CARBON DIOXIDE, REMOTE SENSING, SPACE PLATFORMS

## 15 LAUNCH VEHICLES AND SPACE VEHICLES

**N87-22702\*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

### **STRUCTURAL DYNAMICS AND CONTROL INTERACTION OF FLEXIBLE STRUCTURES**

ROBERT S. RYAN, ed. and HAROLD N. SCOFIELD, ed. Apr. 1987 680 p Workshop held in Huntsville, Ala., 22-24 Apr. 1986

(NASA-CP-2467-PT-1; M-554-PT-1; NAS 1.55:2467-PT-1) Avail: NTIS HC A99/MF E03 CSCL 22B

CONTROL SYSTEMS DESIGN, DYNAMIC STRUCTURAL ANALYSIS, FLEXIBLE BODIES, LARGE SPACE STRUCTURES, SPACECRAFT CONTROL

**N87-22729\*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

### **STRUCTURAL DYNAMICS AND CONTROL INTERACTION OF FLEXIBLE STRUCTURES**

ROBERT S. RYAN, ed. and HAROLD N. SCOFIELD, ed. Apr. 1987 729 p Workshop held in Huntsville, Ala., 22-24 Apr. 1986

(NASA-CP-2467-PT-2; M-554-PT-2; NAS 1.55:2467-PT-2) Avail: NTIS HC A99/MF E03 CSCL 22B

CONFERENCES, DESIGN ANALYSIS, DYNAMIC STRUCTURAL ANALYSIS, FLEXIBLE BODIES, JOINTS (JUNCTIONS), LARGE SPACE STRUCTURES, ORBITAL SPACE STATIONS

## 16

### **SPACE TRANSPORTATION**

Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques.

**N87-12585\*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

### **DEVELOPMENT TESTING OF LARGE VOLUME WATER SPRAYS FOR WARM FOG DISPERSAL**

V. W. KELLER, B. J. ANDERSON, R. A. BURNS, G. G. LALA (New York State Univ., Albany), M. B. MEYER, and K. V. BEARD (Illinois Univ., Urbana-Champaign) Washington Jun. 1986 112 p

(NASA-TP-2607; NAS 1.60:2607) Avail: NTIS HC A06/MF A01 CSCL 14B

COALESCING, FOG DISPERSAL, SPACE SHUTTLES, SPACECRAFT LAUNCHING, SPRAY NOZZLES, WATER

## 18

### **SPACECRAFT DESIGN, TESTING AND PERFORMANCE**

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and attitude controls.

**N87-16014\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

### **NASA/DOD CONTROL/STRUCTURES INTERACTION TECHNOLOGY, 1986**

ROBERT L. WRIGHT, comp. Nov. 1986 549 p Conference held in Norfolk, Va., 18-21 Nov. 1986; sponsored by NASA Langley Research Center and AFWAL

(NASA-CP-2447-PT-1; L-16242-PT-1; NAS 1.55:2447-PT-1) Avail: NTIS HC A23/MF A01 CSCL 22B

ANTENNAS, CONFERENCES, FLEXIBLE SPACECRAFT, LARGE SPACE STRUCTURES, SPACE STATIONS, SPACECRAFT

CONTROL, SPACECRAFT DESIGN, SYSTEMS ENGINEERING, TRUSSES, VIBRATION DAMPING

**N87-24495\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

### **NASA/DOD CONTROL/STRUCTURES INTERACTION TECHNOLOGY, 1986**

ROBERT L. WRIGHT, comp. Jun. 1987 314 p Conference held in Norfolk, Va., 18-21 Nov. 1986

(NASA-CP-2447-PT-2; L-16242-PT-2; NAS 1.55:2447-PT-2)

Avail: NTIS HC A14/MF A01 CSCL 22B

CONTROL STABILITY, CONTROL SYSTEMS DESIGN, INTERACTIVE CONTROL, ORBITAL SPACE STATIONS, SPACECRAFT CONTROL, VIBRATION DAMPING

**N87-26073\*#** National Aeronautics and Space Administration. Washington, D.C.

### **SPACE STATION SYSTEMS: A BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 4)**

May 1987 220 p

(NASA-SP-7056(04); NAS 1.21:7056(04)) Avail: NTIS HC A10 CSCL 22B

This bibliography lists 832 reports, articles, and other documents introduced into the NASA scientific and technical information system between July 1, 1986 and December 31, 1986. Its purpose is to provide helpful information to the researcher, manager, and designer in technology development and mission design according to system, interactive analysis and design, structural and thermal analysis and design, structural concepts and control systems, electronics, advanced materials, assembly concepts, propulsion, and solar power satellite systems. The coverage includes documents that define major systems and subsystems, servicing and support requirements, procedures and operations, and missions for the current and future space station. Author

## 20

### **SPACECRAFT PROPULSION AND POWER**

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.

**N87-20380\*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

### **SOLAR ARRAY FLIGHT EXPERIMENT/DYNAMIC AUGMENTATION EXPERIMENT**

LEIGHTON E. YOUNG and HOMER C. PACK, JR. Feb. 1987 72 p

(NASA-TP-2690; NAS 1.60:2690) Avail: NTIS HC A04/MF A01 CSCL 10A

LARGE SPACE STRUCTURES, SOLAR ARRAYS, SOLAR DYNAMIC POWER SYSTEMS, SPACE ERECTABLE STRUCTURES, SPACE SHUTTLE PAYLOADS

**N87-20381\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

### **EXPERIMENTAL THRUST PERFORMANCE OF A HIGH-AREA-RATIO ROCKET NOZZLE**

ALBERT J. PAVLI, KENNETH J. KACYNSKI, and TAMARA A. SMITH Apr. 1987 16 p Presented at the 23rd JANNAF Combustion Meeting, Hampton, Va., 20-24 Oct. 1986

(NASA-TP-2720; E-3236-1; NAS 1.60:2720) Avail: NTIS HC A02/MF A01 CSCL 21H

AREA, NOZZLE GEOMETRY, ROCKET NOZZLES, ROCKET THRUST

**N87-22766\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.  
**STRUCTURAL INTEGRITY AND DURABILITY OF REUSABLE SPACE PROPULSION SYSTEMS**  
 1987 205 p Conference held in Cleveland, Ohio, 12-13 May 1987

(NASA-CP-2471; E-3512; NAS 1.55:2471) Avail: NTIS HC A10/MF A01 CSCL 21H

AEROTHERMODYNAMICS, CONFERENCES, DURABILITY, DYNAMIC STRUCTURAL ANALYSIS, FATIGUE (MATERIALS), FRACTURE MECHANICS, SPACE SHUTTLE MAIN ENGINE, SPACECRAFT PROPULSION, STRUCTURAL RELIABILITY

**N87-25423\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**COMPARISON OF THEORETICAL AND EXPERIMENTAL THRUST PERFORMANCE OF A 1030:1 AREA RATIO ROCKET NOZZLE AT A CHAMBER PRESSURE OF 2413 KN/M<sup>2</sup> (350 PSIA)**

TAMARA A. SMITH, ALBERT J. PAVLI, and KENNETH J. KACYNSKI 1987 25 p Presented at the 23rd Joint Propulsion Conference, San Diego, Calif., 29 Jun. - 2 Jul. 1987; sponsored by AIAA, SAE, ASME and ASEE

(NASA-TP-2725; E-3523; NAS 1.60:2725; AIAA-87-2069) Avail: NTIS HC A02/MF A01 CSCL 21H

ENGINE TESTS, PREDICTIONS, ROCKET NOZZLES, ROCKET THRUST

**N87-25424\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**EXPERIMENTAL EVALUATION OF HEAT TRANSFER ON A 1030:1 AREA RATIO ROCKET NOZZLE**

KENNETH J. KACYNSKI, ALBERT J. PAVLI, and TAMARA A. SMITH Aug. 1987 28 p Presented at the 23rd Joint Propulsion Conference, San Diego, Calif., 29 Jun. - 2 Jul. 1987; sponsored by AIAA, SAE, ASME and ASEE

(NASA-TP-2726; E-3558; NAS 1.60:2726; AIAA-87-2070) Avail: NTIS HC A03/MF A01 CSCL 21H

EXHAUST NOZZLES, HEAT FLUX, HEAT TRANSFER, NOZZLE FLOW, ROCKET NOZZLES, WALL TEMPERATURE

**N87-25425\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**ANALYSIS OF QUASI-HYBRID SOLID ROCKET BOOSTER CONCEPTS FOR ADVANCED EARTH-TO-ORBIT VEHICLES**

ROBERT L. ZURAWSKI and DOUGLAS C. RAPP (Sverdrup Technology, Inc., Cleveland, Ohio.) Aug. 1987 32 p Presented at the 23rd Joint Propulsion Conference, San Diego, Calif. 29 Jun. - 2 Jul. 1987; sponsored by AIAA, SAE, ASME and ASEE

(NASA-TP-2751; E-3554; NAS 1.60:2751; AIAA-87-2082) Avail: NTIS HC A03/MF A01 CSCL 21H

FEASIBILITY ANALYSIS, HYBRID PROPELLANT ROCKET ENGINES, SPACE SHUTTLE BOOSTERS

## 23

## CHEMISTRY AND MATERIALS (GENERAL)

**N87-18611\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**SPECTROSCOPIC COMPARISON OF EFFECTS OF ELECTRON RADIATION ON MECHANICAL PROPERTIES OF TWO POLYIMIDES**

EDWARD R. LONG, JR. and SHEILA ANN T. LONG Apr. 1987 21 p

(NASA-TP-2663; L-16200; NAS 1.60:2663) Avail: NTIS HC A02/MF A01 CSCL 11C

DURABILITY, ELECTRON RADIATION, KAPTON (TRADE-MARK), RADIATION DAMAGE, TENSILE PROPERTIES

## 24

## COMPOSITE MATERIALS

Includes physical, chemical, and mechanical properties of laminates and other composite materials.

**N87-10184\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**EFFECTS OF THERMAL CYCLING ON GRAPHITE-FIBER-REINFORCED 6061 ALUMINUM**

G. A. DRIES (PRC Kentron, Inc., Hampton, Va.) and S. S. TOMPKINS Oct. 1986 29 p

(NASA-TP-2612; L-16139; NAS 1.60:2612) Avail: NTIS HC A03/MF A01 CSCL 11D

ALUMINUM GRAPHITE COMPOSITES, CARBON FIBERS, METAL MATRIX COMPOSITES, REINFORCING FIBERS, SPACECRAFT STRUCTURES, THERMAL CYCLING TESTS

**N87-25435\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**PRELIMINARY STRUCTURAL DESIGN OF COMPOSITE MAIN ROTOR BLADES FOR MINIMUM WEIGHT**

MARK W. NIXON Jul. 1987 28 p Prepared in cooperation with Army Aviation Research and Development Command, Hampton, Va.

(DA PROJ. 1L1-62209-AH-76)

(NASA-TP-2730; L-16310; NAS 1.60:2730; AVSCOM-TM-87-B-6)

Avail: NTIS HC A03/MF A01 CSCL 11D

BLADES, COMPOSITE MATERIALS, DYNAMIC STRUCTURAL ANALYSIS, HELICOPTERS, ROTORS, WEIGHT REDUCTION

**N87-29612\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**THE ACEE PROGRAM AND BASIC COMPOSITES RESEARCH AT LANGLEY RESEARCH CENTER (1975 TO 1986): SUMMARY AND BIBLIOGRAPHY**

MARVIN B. DOW Oct. 1987 147 p

(NASA-RP-1177; L-16290; NAS 1.61:1177) Avail: NTIS HC A07/MF A01 CSCL 11D

Composites research conducted at the Langley Research Center during the period from 1975 to 1986 is described, and an annotated bibliography of over 600 documents (with their abstracts) is presented. The research includes Langley basic technology and the composite primary structures element of the NASA Aircraft Energy Efficiency (ACEE) Program. The basic technology documents cited in the bibliography are grouped according to the research activity such as design and analysis, fatigue and fracture, and damage tolerance. The ACEE documents cover development of composite structures for transport aircraft. Author



## 25

## INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

**N87-18629\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**ELECTRON STIMULATED DESORPTION OF ATOMIC OXYGEN FROM SILVER**

R. A. OUTLAW, W. K. PEREGOY, GAR B. HOFLUND (Florida Univ., Gainesville), and GREGORY R. CORALLO Apr. 1987 25 p  
(NASA-TP-2668; L-16225; NAS 1.60:2668) Avail: NTIS HC A02/MF A01 CSCL 07D

ATOMIC BEAMS, DESORPTION, ELECTRON EMISSION, OXYGEN, SILVER, STIMULATED EMISSION

## 26

## METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

**N87-16902\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**CONVENTIONALLY CAST AND FORGED COPPER ALLOY FOR HIGH-HEAT-FLUX THRUST CHAMBERS**

JOHN M. KAZAROFF and GEORGE A. REPAS Feb. 1987 12 p  
(NASA-TP-2694; E-3304; NAS 1.60:2694) Avail: NTIS HC A02/MF A01 CSCL 11F

COMBUSTION CHAMBERS, COPPER ALLOYS, HEAT FLUX, HIGH TEMPERATURE, LININGS, SPACE SHUTTLE MAIN ENGINE

**N87-18644\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**EFFECT OF LID (REGISTERED) PROCESSING ON THE MICROSTRUCTURE AND MECHANICAL PROPERTIES OF TI-6AL-4V AND TI-6AL-2SN-4ZR-2MO TITANIUM FOIL-GAUGE MATERIALS**

LINDA B. BALCKBURN Apr. 1987 27 p  
(NASA-TP-2677; L-16098; NAS 1.60:2677) Avail: NTIS HC A03/MF A01 CSCL 11F

BONDING, DIFFUSION, INTERFACES, LIQUIDS, MECHANICAL PROPERTIES, MICROSTRUCTURE, PROTECTIVE COATINGS, TITANIUM ALLOYS

**N87-20407\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**MATERIAL CHARACTERIZATION OF SUPERPLASTICALLY FORMED TITANIUM (TI-6AL-2SN-4ZR-2MO) SHEET**

WILLIAM A. OSSA (PRC Kentron, Inc., Hampton, Va.) and DICK M. ROYSTER 1987 38 p  
(NASA-TP-2674; L-16115; NAS 1.60:2674) Avail: NTIS HC A03/MF A01 CSCL 11F

AEROSPACE INDUSTRY, SUPERPLASTICITY, TENSILE CREEP, TITANIUM ALLOYS

**N87-21076\*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

**THE CORROSION MECHANISMS FOR PRIMER COATED 2219-T87 ALUMINUM**

MERLIN D. DANFORD and WARD W. KNOCKEMUS (Huntingdon Coll., Montgomery, Ala.) Apr. 1987 25 p  
(NASA-TP-2715; M-559; NAS 1.60:2715) Avail: NTIS HC A02/MF A01 CSCL 11F

ALUMINUM ALLOYS, CORROSION RESISTANCE, PRIMERS (COATINGS), PROTECTIVE COATINGS

**N87-25463\*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

**HYDROGEN TRAPPING AND THE INTERACTION OF HYDROGEN WITH METALS**

MERLIN D. DANFORD Jul. 1987 36 p  
(NASA-TP-2744; NAS 1.60:2744) Avail: NTIS HC A03/MF A01 CSCL 11F

CRYSTAL LATTICES, GAS-METAL INTERACTIONS, HYDROGEN, TRAPPING

**N87-27024\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**PERMEATION OF OXYGEN THROUGH HIGH PURITY, LARGE GRAIN SILVER**

R. A. OUTLAW, W. K. PEREGOY, and GAR B. HOFLUND (Florida Univ., Gainesville.) Sep. 1987 19 p  
(NASA-TP-2755; L-16305; NAS 1.60:2755) Avail: NTIS HC A02/MF A01 CSCL 11F

GRAIN BOUNDARIES, OXYGEN, PERMEATING, PURITY, SILVER

## 27

## NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

**N87-12680\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**INVESTIGATION OF THE EFFECTS OF COBALT IONS ON EPOXY PROPERTIES**

J. J. SINGH and D. M. STOAKLEY Dec. 1986 16 p  
(NASA-TP-2639; L-16196; NAS 1.60:2639) Avail: NTIS HC A02/MF A01 CSCL 11G

COBALT, EPOXY RESINS, INVESTIGATION, IONS, MECHANICAL PROPERTIES

**N87-18666\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**ESTER OXIDATION ON AN ALUMINUM SURFACE USING CHEMILUMINESCENCE**

WILLIAM R. JONES, JR., MICHAEL A. MEADOR, and WILFREDO MORALES Jul. 1986 16 p  
(NASA-TP-2611; E-2647; NAS 1.60:2611) Avail: NTIS HC A02/MF A01 CSCL 11B

ALUMINUM ALLOYS, CHEMILUMINESCENCE, ESTERS, METAL SURFACES, OXIDATION

## COMMUNICATIONS AND RADAR

Includes radar; land and global communications; communications theory; and optical communications.

**N87-11916\*#** National Aeronautics and Space Administration. Wallops Flight Center, Wallops Island, Va.  
**PULSE CODE MODULATION (PCM) ENCODER HANDBOOK FOR AYDIN VECTOR MMP-600 SERIES SYSTEM**  
 S. F. CURRIER and W. R. POWELL Washington, D.C. Aug. 1986 139 p  
 (NASA-RP-1171; NAS 1.61:1171) Avail: NTIS HC A07/MF A01 CSCL 17B

The hardware and software characteristics of a time division multiplex system are described. The system is used to sample analog and digital data. The data is merged with synchronization information to produce a serial pulse coded modulation (PCM) bit stream. Information presented herein is required by users to design compatible interfaces and assure effective utilization of this encoder system. GSFC/Wallops Flight Facility has flown approximately 50 of these systems through 1984 on sounding rockets with no inflight failures. Aydin Vector manufactures all of the components for these systems. Author

**N87-12718\*#** National Aeronautics and Space Administration. Wallops Flight Center, Wallops Island, Va.  
**PULSE CODE MODULATION (PCM) DATA STORAGE AND ANALYSIS USING A MICROCOMPUTER**  
 D. E. MASSEY Aug. 1986 8 p  
 (NASA-TP-2629; REPT-822.3; NAS 1.60:2629) Avail: NTIS HC A02/MF A01 CSCL 17B

DATA PROCESSING, DATA REDUCTION, DATA STORAGE, MICROCOMPUTERS, PULSE CODE MODULATION

**N87-17971\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.  
**BIT-ERROR-RATE TESTING OF HIGH-POWER 30-GHZ TRAVELING WAVE TUBES FOR GROUND-TERMINAL APPLICATIONS**  
 KURT A. SHALKHAUSER and GENE FUJIKAWA Oct. 1986 16 p  
 (NASA-TP-2635; E-2996; NAS 1.60:2635) Avail: NTIS HC A02/MF A01 CSCL 17B  
 BIT ERROR RATE, PERFORMANCE TESTS, TRANSMISSION EFFICIENCY, TRAVELING WAVE TUBES

**N87-20448\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.  
**UNIQUE BIT-ERROR-RATE MEASUREMENT SYSTEM FOR SATELLITE COMMUNICATION SYSTEMS**  
 MARY JO WINDMILLER Mar. 1987 13 p  
 (NASA-TP-2699; E-3322; NAS 1.60:2699) Avail: NTIS HC A02/MF A01 CSCL 17B  
 BIT ERROR RATE, COMMUNICATION NETWORKS, SATELLITE COMMUNICATION, SYSTEMS ANALYSIS

**N87-24590\*#** National Aeronautics and Space Administration. Wallops Flight Center, Wallops Island, Va.  
**A SYNCHRONOUS DATA ANALYZER FOR THE MINIMUM DELAY DATA FORMAT (MDDF) AND LAUNCH TRAJECTORY ACQUISITION SYSTEM (LTAS)**  
 ANDREW J. GREEN Jul. 1987 10 p  
 (NASA-TP-2743; REPT-822.1; NAS 1.60:2743) Avail: NTIS HC A02/MF A01 CSCL 17B  
 DATA REDUCTION, LAUNCHING, SAMPLING, SYNCHRONISM, TRAJECTORY ANALYSIS

**N87-20423\*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.  
**MICROGRAVITY CRYSTALLIZATION OF MACROMOLECULES: AN INTERIM REPORT AND PROPOSAL FOR CONTINUED RESEARCH**  
 BENJAMIN E. GOLDBERG Dec. 1986 26 p  
 (NASA-TP-2671; NAS 1.60:2671) Avail: NTIS HC A03/MF A01 CSCL 20B  
 MOLECULES, POLYMER CHEMISTRY, RECRYSTALLIZATION, REDUCED GRAVITY

## MATERIALS PROCESSING

Includes space-based development of products and processes for commercial applications.

**N87-21141\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.  
**MICROGRAVITY FLUID MANAGEMENT SYMPOSIUM**  
 Apr. 1987 225 p Symposium held in Cleveland, Ohio, 9-10 Sep. 1986  
 (NASA-CP-2465; E-3386; NAS 1.55:2465) Avail: NTIS HC A10/MF A01 CSCL 22A  
 AEROSPACE ENVIRONMENTS, CONFERENCES, FLUID MANAGEMENT, WEIGHTLESSNESS

## ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; cryogenics; and fire prevention.

**N87-22870\*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.  
**MODELING DIGITAL CONTROL SYSTEMS WITH MA-PREFILTERED MEASUREMENTS**  
 MICHAEL E. POLITES Jun. 1987 23 p  
 (NASA-TP-2732; NAS 1.60:2732) Avail: NTIS HC A02/MF A01 CSCL 13H  
 CONTROL SYSTEMS DESIGN, DIGITAL FILTERS, DIGITAL SYSTEMS, STATE VECTORS, SYSTEMS ENGINEERING

**N87-24585\*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.  
**A NEW APPROACH TO STATE ESTIMATION IN DETERMINISTIC DIGITAL CONTROL SYSTEMS**  
 MICHAEL E. POLITES Jul. 1987 16 p  
 (NASA-TP-2745; NAS 1.60:2745) Avail: NTIS HC A02/MF A01 CSCL 09B  
 CONTROL SYSTEMS DESIGN, DIGITAL SYSTEMS, STATE ESTIMATION

**N87-27067\*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.  
**EXACT STATE RECONSTRUCTION IN DETERMINISTIC DIGITAL CONTROL SYSTEMS**  
 MICHAEL E. POLITES Aug. 1987 19 p  
 (NASA-TP-2757; NAS 1.60:2757) Avail: NTIS HC A02/MF A01 CSCL 13H  
 DIGITAL COMMAND SYSTEMS, STATE ESTIMATION, STATE VECTORS

## ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

**N87-11072\*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**THE 1985 GODDARD SPACE FLIGHT CENTER BATTERY WORKSHOP**

G. MORROW, ed. Sep. 1986 427 p Workshop held in Greenbelt, Md., 19-21 Nov. 1985

(NASA-CP-2434; REPT-86B0366; NAS 1.55:2434) Avail: NTIS HC A19/MF A01 CSCL 10C

CONFERENCES, ENERGY STORAGE, LITHIUM SULFUR BATTERIES, NICKEL CADMIUM BATTERIES, NICKEL HYDROGEN BATTERIES

**N87-17990\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**PERFORMANCE OF TEXTURED CARBON ON COPPER ELECTRODE MULTISTAGE DEPRESSED COLLECTORS WITH MEDIUM-POWER TRAVELING WAVE TUBES**

PETER RAMINS and ARTHUR N. CURREN Nov. 1986 12 p

(NASA-TP-2665; E-3143; NAS 1.60:2665) Avail: NTIS HC A02/MF A01 CSCL 09A

ACCUMULATORS, CURRENT DENSITY, ELECTRODES, ELECTRON EMISSION, TRAVELING WAVE TUBES

**N87-17991\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**CALCULATION OF SECONDARY ELECTRON TRAJECTORIES IN MULTISTAGE DEPRESSED COLLECTORS FOR MICROWAVE AMPLIFIERS**

DALE A. FORCE Nov. 1986 7 p

(NASA-TP-2664; E-3196; NAS 1.60:2664) Avail: NTIS HC A02/MF A01 CSCL 09A

ACCUMULATORS, ELECTRON EMISSION, MICROWAVE AMPLIFIERS, PARTICLE TRAJECTORIES, TRAVELING WAVE TUBES

**N87-20474\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**DESIGN, FABRICATION AND PERFORMANCE OF SMALL GRAPHITE ELECTRODE, MULTISTAGE DEPRESSED COLLECTORS WITH 200-W, CW, 8- TO 18-GHZ TRAVELING-WAVE TUBES**

BEN T. EBIHARA and PETER RAMINS Feb. 1987 22 p

(NASA-TP-2693; E-3099; NAS 1.60:2693) Avail: NTIS HC A02/MF A01 CSCL 09A

ACCUMULATORS, DESIGN ANALYSIS, ELECTRODES, FABRICATION, PYROLYTIC GRAPHITE, TRAVELING WAVE TUBES

**N87-21239\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**TRAVELING-WAVE-TUBE EFFICIENCY IMPROVEMENT BY A LOW-COST TECHNIQUE FOR DEPOSITION OF CARBON ON MULTISTAGE DEPRESSED COLLECTOR**

BEN T. EBIHARA, PETER RAMINS, and SHELLY PEET May 1987 14 p

(NASA-TP-2719; E-3416; NAS 1.60:2719) Avail: NTIS HC A02/MF A01 CSCL 09A

CARBON, COPPER, DEPOSITION, ELECTRODES, THIN FILMS, TRAVELING WAVE TUBES

**N87-22923\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**REVISED NASA AXIALLY SYMMETRIC RING MODEL FOR COUPLED-CAVITY TRAVELING-WAVE TUBES**

JEFFREY D. WILSON Jan. 1987 17 p

(NASA-TP-2675; E-3220; NAS 1.60:2675) Avail: NTIS HC A02/MF A01 CSCL 09A

AXISYMMETRIC BODIES, CAVITIES, COUPLED MODES, MODELS, RINGS, TRAVELING WAVE TUBES

**N87-25532\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**ANALYTICAL AND EXPERIMENTAL PERFORMANCE OF A DUAL-MODE TRAVELING WAVE TUBE AND MULTISTAGE DEPRESSED COLLECTOR**

PETER RAMINS, DALE A. FORCE, and HENRY G. KOSMAHL Aug. 1987 29 p

(NASA-TP-2752; E-3470; NAS 1.60:2752) Avail: NTIS HC A03/MF A01 CSCL 09A

ACCUMULATORS, ELECTRON BEAMS, TRAVELING WAVE TUBES

## FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

**N87-11963\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**ON THE MAXWELLIAN DISTRIBUTION, SYMMETRIC FORM, AND ENTROPY CONSERVATION FOR THE EULER EQUATIONS**

S. M. DESHPANDE Nov. 1986 30 p

(NASA-TP-2583; L-16036; NAS 1.60:2583) Avail: NTIS HC A03/MF A01 CSCL 20D

ENTROPY, EULER EQUATIONS OF MOTION, MAXWELL-BOLTZMANN DENSITY FUNCTION

**N87-13664\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**AEROTHERMAL TESTS OF SPHERICAL DOME PROTUBERANCES ON A FLAT PLATE AT A MACH NUMBER OF 6.5.**

C. E. GLASS and L. R. HUNT Dec. 1986 61 p

(NASA-TP-2631; L-16160; NAS 1.60:2631) Avail: NTIS HC A04/MF A01 CSCL 20D

AEROTHERMODYNAMICS, HYPERSONIC VEHICLES, LAMINAR BOUNDARY LAYER, PREDICTION ANALYSIS TECHNIQUES, PROTUBERANCES, THERMAL PROTECTION, TILES, TURBULENT BOUNDARY LAYER

**N87-17000\*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

**SPACE SHUTTLE MAIN ENGINE HIGH PRESSURE FUEL PUMP AFT PLATFORM SEAL CAVITY FLOW ANALYSIS**

S. A. LOWRY and L. W. KEETON (CHAM of North America, Inc., Huntsville, Ala.) Jan. 1987 134 p

(NASA-TP-2685; NAS 1.60:2685) Avail: NTIS HC A07/MF A01 CSCL 20D

CAVITIES, FUEL PUMPS, HIGH PRESSURE, SEALS (STOPPERS), SPACE SHUTTLE MAIN ENGINE, TURBINE PUMPS

**N87-18034\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**JET MODEL FOR SLOT FILM COOLING WITH EFFECT OF FREE-STREAM AND COOLANT TURBULENCE**

FREDERICK F. SIMON Oct. 1986 21 p  
(NASA-TP-2655; E-2961; NAS 1.60:2655) Avail: NTIS HC  
A02/MF A01 CSCL 20D

FILM COOLING, FLOW VELOCITY, JET ENGINES, NUMERICAL ANALYSIS, TURBULENCE EFFECTS, WALL JETS

**N87-18035\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**VELOCITY PROFILES IN LAMINAR DIFFUSION FLAMES**

VALERIE J. LYONS and JANICE M. MARGLE (Pennsylvania State Univ., Abington) May 1986 13 p Presented at the Combustion Inst. Meeting, Cleveland, Ohio, 5-6 May 1986  
(NASA-TP-2596; E-2879; NAS 1.60:2596) Avail: NTIS HC  
A02/MF A01 CSCL 20D

CYCLOHEXANE, DIFFUSION FLAMES, ETHYL ALCOHOL, HEPTANES, LAMINAR FLOW, OCTANES, TEMPERATURE PROFILES, VELOCITY MEASUREMENT

**N87-18782\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**AEROTHERMAL EVALUATION OF A SPHERICALLY BLUNTED BODY WITH A TRAPEZOIDAL CROSS SECTION IN THE LANGLEY 8-FOOT HIGH-TEMPERATURE TUNNEL**

CINDY W. ALBERTSON Apr. 1987 83 p  
(NASA-TP-2641; L-16096; NAS 1.60:2641) Avail: NTIS HC  
A05/MF A01 CSCL 20D

BOUNDARY LAYERS, FLOW DISTRIBUTION, HEAT TRANSFER, PREDICTIONS, PRESSURE MEASUREMENT, THERMAL PROTECTION

**N87-18783\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**A SECOND-ORDER ACCURATE KINETIC-THEORY-BASED METHOD FOR INVISCID COMPRESSIBLE FLOWS**

SURESH M. DESHPANDE Dec. 1986 42 p  
(NASA-TP-2613; L-16050; NAS 1.60:2613) Avail: NTIS HC  
A03/MF A01 CSCL 20D

BOLTZMANN TRANSPORT EQUATION, EULER EQUATIONS OF MOTION, KINETIC THEORY, NUMERICAL ANALYSIS, SHOCK WAVE PROPAGATION

**N87-22103\*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

**SPACELAB 3 MISSION SCIENCE REVIEW**

GEORGE H. FICHTL, ed., JOHN S. THEON, ed. (National Aeronautics and Space Administration, Washington, D.C.), CHARLES K. HILL, ed., and OTHA H. VAUGHAN, ed. Feb. 1987 98 p Symposium held in Huntsville, Ala., 4 Dec. 1985  
(NASA-CP-2429; M-547; NAS 1.55:2429) Avail: NTIS HC  
A05/MF A01 CSCL 22A

AEROSPACE ENVIRONMENTS, POSTFLIGHT ANALYSIS, REDUCED GRAVITY, SPACE COMMERCIALIZATION, SPACE SHUTTLES, SPACEBORNE EXPERIMENTS, SPACELAB

**N87-23921\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**THREE-STEP LABYRINTH SEAL FOR HIGH-PERFORMANCE TURBOMACHINES**

ROBERT C. HENDRICKS Jun. 1987 75 p  
(NASA-TP-1848; E-3186; NAS 1.60:1848) Avail: NTIS HC  
A04/MF A01 CSCL 20D

FUEL PUMPS, LABYRINTH SEALS, SPACE SHUTTLE MAIN ENGINE, STATIC TESTS, TURBOMACHINERY

**N87-23936\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**STRAIGHT CYLINDRICAL SEAL FOR HIGH-PERFORMANCE TURBOMACHINES**

ROBERT C. HENDRICKS Jun. 1987 76 p  
(NASA-TP-1850; E-3184; NAS 1.60:1850) Avail: NTIS HC  
A05/MF A01 CSCL 20D

CYLINDRICAL BODIES, FUEL PUMPS, SEALS (STOPPERS), SPACE SHUTTLE MAIN ENGINE, TURBINE PUMPS, TURBOMACHINERY

**N87-24639\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**THREE-STEP CYLINDRICAL SEAL FOR HIGH-PERFORMANCE TURBOMACHINES**

ROBERT C. HENDRICKS Jun. 1987 79 p  
(NASA-TP-1849; E-3185; NAS 1.60:1849) Avail: NTIS HC  
A05/MF A01 CSCL 20D

DYNAMIC STABILITY, FUEL PUMPS, LEAKAGE, PUMP SEALS, SPACE SHUTTLE MAIN ENGINE, TURBINE PUMPS

**N87-24672\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**MULTISCALE TURBULENCE EFFECTS IN SUPERSONIC JETS EXHAUSTING INTO STILL AIR**

KHALED S. ABDOL-HAMID (Analytical Services and Materials, Inc., Hampton, Va.) and RICHARD G. WILMOTH Jul. 1987 38 p  
(NASA-TP-2707; L-16258; NAS 1.60:2707) Avail: NTIS HC  
A03/MF A01 CSCL 20D

JET EXHAUST, NAVIER-STOKES EQUATION, SUPERSONIC AIRCRAFT, TURBULENCE

**N87-26309\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**SIMPLIFIED CURVE FITS FOR THE THERMODYNAMIC PROPERTIES OF EQUILIBRIUM AIR**

S. SRINIVASAN, J. C. TANNEHILL (Iowa State Univ. of Science and Technology, Ames.), and K. J. WEILMUENSTER Aug. 1987 48 p  
(NAG1-313)

(NASA-RP-1181; L-16276; NAS 1.61:1181) Avail: NTIS HC  
A03/MF A01 CSCL 20D

New, improved curve fits for the thermodynamic properties of equilibrium air have been developed. The curve fits are for pressure, speed of sound, temperature, entropy, enthalpy, density, and internal energy. These curve fits can be readily incorporated into new or existing computational fluid dynamics codes if real gas effects are desired. The curve fits are constructed from Grabau-type transition functions to model the thermodynamic surfaces in a piecewise manner. The accuracies and continuity of these curve fits are substantially improved over those of previous curve fits. These improvements are due to the incorporation of a small number of additional terms in the approximating polynomials and careful choices of the transition functions. The ranges of validity of the new curve fits are temperatures up to 25 000 K and densities from 10 to the  $-7$  to 10 to the 3d power amagats. Author

**N87-27161\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**APPLICATION OF TURBULENCE MODELING TO PREDICT SURFACE HEAT TRANSFER IN STAGNATION FLOW REGION OF CIRCULAR CYLINDER**

CHI R. WANG and FREDERICK C. YEH Sep. 1987 25 p  
(NASA-TP-2758; E-3418; NAS 1.60:2758) Avail: NTIS HC  
A02/MF A01 CSCL 20D

CIRCULAR CYLINDERS, HEAT TRANSFER, MODELS, STAGNATION FLOW, SURFACE PROPERTIES, TURBULENCE

**N87-29778\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.  
**DESCRIPTION AND CALIBRATION OF THE LANGLEY HYPERSONIC CF4 TUNNEL: A FACILITY FOR SIMULATING LOW GAMMA FLOW AS OCCURS FOR A REAL GAS**  
 RAYMOND E. MIDDEN and CHARLES G. MILLER, III Mar. 1985 78 p  
 (NASA-TP-2384; L-15798; NAS 1.60:2384) Avail: NTIS HC A05/MF A01 CSCL 20D

CALIBRATING, CARBON TETRAFLUORIDE, HYPERSONIC WIND TUNNELS, MACH NUMBER, REAL GASES, TEST FACILITIES

**N87-29795\*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.  
**FINITE-ELEMENT REENTRY HEAT-TRANSFER ANALYSIS OF SPACE SHUTTLE ORBITER**  
 WILLIAM L. KO, ROBERT D. QUINN, and LESLIE GONG Dec. 1986 59 p  
 (NASA-TP-2657; H-1236; NAS 1.60:2657) Avail: NTIS HC A04/MF A01 CSCL 20D  
 AERODYNAMIC HEATING, FINITE ELEMENT METHOD, HEAT TRANSFER COEFFICIENTS, REENTRY SHIELDING, SPACE SHUTTLE ORBITERS, THERMAL ANALYSIS

## 35

## INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

**N87-10263\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.  
**THIRTEENTH INTERNATIONAL LASER RADAR CONFERENCE**  
 Aug. 1986 335 p Conference held in Toronto, Ontario, 11-15 Aug. 1986; sponsored by NASA, Washington, D.C., Atmospheric Environment Service, and York Univ.  
 (NASA-CP-2431; L-16201; NAS 1.55:2431) Avail: NTIS HC A15/MF A01 CSCL 20E  
 CONFERENCES, LASER APPLICATIONS, LASERS, METEOROLOGICAL PARAMETERS, MIDDLE ATMOSPHERE, OPTICAL RADAR, RADAR EQUIPMENT

**N87-13731\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.  
**EVALUATION OF DIFFUSE-ILLUMINATION HOLOGRAPHIC CINEMATOGRAPHY IN A FLUTTER CASCADE**  
 A. J. DECKER Jul. 1986 33 p  
 (NASA-TP-2593; E-2937; NAS 1.60:2593) Avail: NTIS HC A03/MF A01 CSCL 14E  
 CINEMATOGRAPHY, FLOW VISUALIZATION, HOLOGRAPHIC INTERFEROMETRY, HOLOGRAPHY, LASER OUTPUTS, THREE DIMENSIONAL FLOW

**N87-20514\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.  
**A SIMPLIFIED METHOD FOR DETERMINING HEAT OF COMBUSTION OF NATURAL GAS**  
 JAG J. SINGH, HOSHANG CHEGINI (Old Dominion Univ., Norfolk, Va.), and GERALD H. MALL (Computer Sciences Corp., Hampton, Va.) Apr. 1987 15 p  
 (NASA-TP-2682; L-16261; NAS 1.60:2682) Avail: NTIS HC A02/MF A01 CSCL 14B  
 GAS DETECTORS, HEAT OF COMBUSTION, NATURAL GAS, OXYGEN SUPPLY EQUIPMENT

## 36

## LASERS AND MASERS

Includes parametric amplifiers.

**N87-20522\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.  
**CLOSED-CYCLE, FREQUENCY-STABLE CO2 LASER TECHNOLOGY**  
 CARMEN E. BATTEN, ed., IRVIN M. MILLER, ed., GEORGE M. WOOD, JR., ed., and DAVID V. WILLETTTS, ed. (Royal Signals and Radar Establishment, Malvern, England.) Apr. 1987 279 p  
 Workshop held in Hampton, Va., 10-12 Jun. 1986  
 (NASA-CP-2456; L-16271; NAS 1.55:2456) Avail: NTIS HC A13/MF A01 CSCL 20E  
 CARBON DIOXIDE LASERS, CLOSED CYCLES, FREQUENCY STABILITY, RESEARCH MANAGEMENT

**N87-27994\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.  
**FREQUENCY DOMAIN LASER VELOCIMETER SIGNAL PROCESSOR: A NEW SIGNAL PROCESSING SCHEME**  
 JAMES F. MEYERS and JAMES I. CLEMMONS, JR. Sep. 1987 38 p  
 (NASA-TP-2735; L-16209; NAS 1.60:2735) Avail: NTIS HC A03/MF A01 CSCL 20E  
 DOMAINS, FREQUENCIES, LASER DOPPLER VELOCIMETERS, SIGNAL PROCESSING

## 37

## MECHANICAL ENGINEERING

Includes auxiliary systems (nonpower); machine elements and processes; and mechanical equipment.

**N87-10391\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.  
**TESTING OF UH-60A HELICOPTER TRANSMISSION IN NASA LEWIS 2240-KW (3000-HP) FACILITY**  
 A. M. MITCHELL, F. B. OSWALD, and H. H. COE Aug. 1986 30 p  
 (NASA-TP-2626; E-2941; NAS 1.60:2626) Avail: NTIS HC A03/MF A01 CSCL 13I  
 HELICOPTERS, TRANSMISSIONS (MACHINE ELEMENTS), VIBRATION MEASUREMENT

**N87-18095\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.  
**PREDICTED EFFECT OF DYNAMIC LOAD ON PITTING FATIGUE LIFE FOR LOW-CONTACT-RATIO SPUR GEARS**  
 DAVID G. LEWICKI Jun. 1986 19 p  
 (NASA-TP-2610; E-2989; NAS 1.60:2610; AD-A170906; AVSCOM-TR-86-C-21) Avail: NTIS HC A02/MF A01 CSCL 13I  
 APPLICATIONS PROGRAMS (COMPUTERS), DYNAMIC LOADS, FATIGUE (MATERIALS), GEARS, LIFE (DURABILITY), PITTING

**N87-18821\*#** National Aeronautics and Space Administration. Washington, D.C.  
**TETHER DYNAMICS SIMULATION**  
 Feb. 1987 338 p Workshop held in Arlington, Va., 16 Sep. 1986  
 (NASA-CP-2458; NAS 1.55:2458) Avail: NTIS HC A15/MF A01 CSCL 22B  
 COMPUTERIZED SIMULATION, ELECTRODYNAMICS, TETHERED SATELLITES, TETHERLINES

**N87-20555\*#** National Aeronautics and Space Administration.  
Lewis Research Center, Cleveland, Ohio.

**VIBRATION CHARACTERISTICS OF OH-58A HELICOPTER MAIN ROTOR TRANSMISSION**

DAVID G. LEWICKI and JOHN J. COY Apr. 1987 18 p  
(NASA-TP-2705; E-3368; NAS 1.60:2705; AVSCOM-TR-86-C-42;  
AD-A180364) Avail: NTIS HC A01/MF A01 CSCL 01C  
HELICOPTERS, ROTOR AERODYNAMICS, TRANSMISSIONS  
(MACHINE ELEMENTS), VIBRATION MEASUREMENT

**N87-22199\*#** National Aeronautics and Space Administration.  
Lewis Research Center, Cleveland, Ohio.

**ROTORDYNAMIC INSTABILITY PROBLEMS IN HIGH-PERFORMANCE TURBOMACHINERY, 1986**

Jan. 1987 548 p Workshop held in College Station, Tex., 2-4  
Jun. 1986; sponsored in cooperation with Texas A&M Univ., Army  
Research Office, and Air Force Aeropropulsion Lab.  
(NASA-CP-2443; E-3136; NAS 1.55:2443) Avail: NTIS HC  
A23/MF A01 CSCL 13I

ROTOR AERODYNAMICS, STABILITY, TURBOCOMPRESSORS, TURBOMACHINERY

**N87-22235\*#** National Aeronautics and Space Administration.  
Lewis Research Center, Cleveland, Ohio.

**GEAR TOOTH STRESS MEASUREMENTS ON THE UH-60A HELICOPTER TRANSMISSION**

FRED B. OSWALD Mar. 1987 17 p  
(NASA-TP-2698; E-3357; NAS 1.60:2698) Avail: NTIS HC  
A02/MF A01 CSCL 13I

GEAR TEETH, STRESS MEASUREMENT, TRANSMISSIONS  
(MACHINE ELEMENTS), UH-60A HELICOPTER

## 38

### QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

**N87-27204\*#** National Aeronautics and Space Administration.  
Langley Research Center, Hampton, Va.

**ELECTRONICS RELIABILITY AND MEASUREMENT TECHNOLOGY**

JOSEPH S. HEYMAN, ed. Aug. 1987 143 p Conference held  
in Hampton, Va., 3-5 Jun. 1986; sponsored by NASA Langley  
Research Center, USAF, National Security Industrial Association,  
and the Aerospace Industry Association  
(NASA-CP-2472; L-16315; NAS 1.55:2472) Avail: NTIS HC  
A07/MF A01 CSCL 14D

COMPONENT RELIABILITY, INSPECTION, MICROELECTRONICS, NONDESTRUCTIVE TESTS, QUALITY CONTROL, RELIABILITY ENGINEERING

**N87-28025\*#** National Aeronautics and Space Administration.  
Langley Research Center, Hampton, Va.

**A TECHNIQUE FOR EVALUATING THE APPLICATION OF THE PIN-LEVEL STUCK-AT FAULT MODEL TO VLSI CIRCUITS**

DANIEL L. PALUMBO and GEORGE B. FINELLI Sep. 1987  
45 p  
(NASA-TP-2738; L-16269; NAS 1.60:2738) Avail: NTIS HC  
A03/MF A01 CSCL 14D

COMPUTERS, ERROR ANALYSIS, EVALUATION, FAULT TOLERANCE, INTEGRATED CIRCUITS, VERY LARGE SCALE INTEGRATION

## 39

### STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

**N87-11180\*#** National Aeronautics and Space Administration.  
Lewis Research Center, Cleveland, Ohio.

**TURBINE ENGINE HOT SECTION TECHNOLOGY, 1984**

Oct. 1984 400 p Conference held in Cleveland, Ohio, 23-24  
Oct. 1984

(NASA-CP-2339; E-2267; NAS 1.55:2339) Avail: NTIS HC  
A17/MF A01 CSCL 20K

AIRCRAFT ENGINES, AIRFOILS, CONFERENCES, LIFE (DURABILITY) LININGS, MATHEMATICAL MODELS, PREDICTION ANALYSIS TECHNIQUES, ROTOR BLADES (TURBOMACHINERY), TURBINE ENGINES

**N87-12921\*#** National Aeronautics and Space Administration.  
Marshall Space Flight Center, Huntsville, Ala.

**EFFECTS OF VARIABLES UPON PYROTECHNICALLY INDUCED SHOCK RESPONSE SPECTRA**

J. L. SMITH May 1986 61 p  
(NASA-TP-2603; NAS 1.60:2603) Avail: NTIS HC A04/MF A01  
CSCL 20K

PYROTECHNICS, SHOCK LOADS, SHOCK SPECTRA, VARIABILITY

**N87-13789\*#** National Aeronautics and Space Administration.  
Langley Research Center, Hampton, Va.

**EFFECTS OF WINGLET ON TRANSONIC FLUTTER CHARACTERISTICS OF A CANTILEVERED TWIN-ENGINE-TRANSPORT WING MODEL**

C. L. RUHLIN, K. G. BHATIA (Boeing Commercial Airplane Co.,  
Seattle, Wash.), and K. S. NAGARAJA Dec. 1986 77 p  
(NASA-TP-2627; L-16095; NAS 1.60:2627) Avail: NTIS HC  
A05/MF A01 CSCL 20K

AERODYNAMIC CONFIGURATIONS, FLUTTER, PREDICTION ANALYSIS TECHNIQUES, TRANSONIC FLOW, WIND TUNNEL TESTS, WINGLETS, WINGS

**N87-16321\*#** National Aeronautics and Space Administration.  
Lewis Research Center, Cleveland, Ohio.

**THE 20TH AEROSPACE MECHANICS SYMPOSIUM**

May 1986 316 p Symposium held in Cleveland, Ohio, 7-9 May  
1986; sponsored by NASA, the California Inst. of Tech. and  
LMSC

(NASA-CP-2423-REV; E-2904; NAS 1.55:2423-REV) Avail: NTIS  
HC A14/MF A01 CSCL 20K

ACTUATORS, CONFERENCES, FLEXIBLE SPACECRAFT, HYDRAULIC EQUIPMENT, JOINTS (JUNCTIONS), MANIPULATORS, SPACE STATIONS, SPACECRAFT INSTRUMENTS, SPUTTERING, TRIBOLOGY

**N87-18855\*#** National Aeronautics and Space Administration.  
Langley Research Center, Hampton, Va.

**SENSITIVITY ANALYSIS IN ENGINEERING**

HOWARD M. ADELMAN, comp. and RAPHAEL T. HAFTKA, comp.  
(Virginia Polytechnic Inst. and State Univ., Blacksburg) Feb.  
1987 369 p Symposium held in Hampton, Va., 25-26 Sep.  
1986

(NASA-CP-2457; L-16278; NAS 1.55:2457) Avail: NTIS HC  
A16/MF A01 CSCL 20K

DYNAMIC STRUCTURAL ANALYSIS, EIGENVALUES, MODAL RESPONSE, OPTIMIZATION, SENSITIVITY

**N87-20566\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.  
**SHOT PEENING FOR TI-6AL-4V ALLOY COMPRESSOR BLADES**

GERALD A. CAREK Apr. 1987 9 p  
 (NASA-TP-2711; E-3430; NAS 1.60:2711) Avail: NTIS HC A01/MF A01 CSCL 20K

ALUMINUM, COMPRESSOR BLADES, SHOT PEENING, TITANIUM ALLOYS, VANADIUM

**N87-20567\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**MODELING OF JOINTS FOR THE DYNAMIC ANALYSIS OF TRUSS STRUCTURES**

W. KEITH BELVIN May 1987 43 p  
 (NASA-TP-2661; L-16163; NAS 1.60:2661) Avail: NTIS HC A03/MF A01 CSCL 20K

DYNAMIC STRUCTURAL ANALYSIS, JOINTS (JUNCTIONS), LARGE SPACE STRUCTURES, MODELS, TRUSSES

**N87-20568\*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

**SPACE STATION STRUCTURES AND DYNAMICS TEST PROGRAM**

CARLETON J. MOORE, JOHN S. TOWNSEND, and EDWARD W. IVEY Mar. 1987 47 p  
 (NASA-TP-2710; NAS 1.60:2710) Avail: NTIS HC A03/MF A01 CSCL 20K

DYNAMIC STRUCTURAL ANALYSIS, DYNAMIC TESTS, LARGE SPACE STRUCTURES, SPACE STATION STRUCTURES, SPACE STATIONS, SYSTEMS ANALYSIS

**N87-27231\*#** Computer Software Management and Information Center, Athens, Ga.

**FIFTEENTH NASTRAN USERS' COLLOQUIUM**

Aug. 1987 312 p Colloquium held in Kansas City, Mo., 4-8 May 1987  
 (NASW-3247)

(NASA-CP-2481; NAS 1.55:2481) Avail: NTIS HC A14/MF A01; also available from COSMIC, Athens, Ga. 30602 CSCL 20K

COMPUTER AIDED DESIGN, COMPUTER TECHNIQUES, CONFERENCES, FINITE ELEMENT METHOD, NASTRAN, STRUCTURAL ANALYSIS, STRUCTURAL VIBRATION

**N87-29858\*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

**THE 21ST AEROSPACE MECHANISMS SYMPOSIUM**

May 1987 356 p Symposium held in Houston, Tex., 29 Apr. - 1 May 1987; sponsored by NASA, California Inst. of Tech., and LMSC

(NASA-CP-2470; S-560; NAS 1.55:2470) Avail: NTIS HC A16/MF A01 CSCL 20K

ACTUATORS, DEPLOYMENT, LARGE SPACE STRUCTURES, MANIPULATORS, ROBOTICS, SPACE ERECTABLE STRUCTURES

## GEOSCIENCES (GENERAL)

**N87-18139\*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**GEOMORPHOLOGY FROM SPACE: A GLOBAL OVERVIEW OF REGIONAL LANDFORMS**

NICHOLAS M. SHORT, ed. and ROBERT W. BLAIR, JR., ed. (Fort Lewis A&M Coll., Durango, Colo.) 1986 737 p Original contains color illustrations

(NASA-SP-486; NAS 1.21:486; LC-86-17974) Avail: SOD HC \$41.00 as 033-000-00994-1; NTIS MF E03 CSCL 08E

This book, Geomorphology from Space: A Global Overview of Regional Landforms, was published by NASA STIF as a successor to the two earlier works on the same subject: Mission to Earth: LANDSAT views the Earth, and ERTS-1: A New Window on Our Planet. The purpose of the book is threefold: first, to serve as a stimulant in rekindling interest in descriptive geomorphology and landforms analysis at the regional scale; second, to introduce the community of geologists, geographers, and others who analyze the Earth's surficial forms to the practical value of space-acquired remotely sensed data in carrying out their research and applications; and third, to foster more scientific collaboration between geomorphologists who are studying the Earth's landforms and astrogeologists who analyze landforms on other planets and moons in the solar system, thereby strengthening the growing field of comparative planetology.

F.M.R.

## EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

**N87-22281\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**SURFACE BIDIRECTIONAL REFLECTANCE PROPERTIES OF TWO SOUTHWESTERN ARIZONA DESERTS FOR WAVELENGTHS BETWEEN 0.4 AND 2.2 MICROMETERS**

CHARLES H. WHITLOCK, G. CARLTON PURGOLD, and STUART R. LECROY (PRC Kentron, Inc., Hampton, Va.) May 1987 48 p

(NASA-TP-2643; L-16159; NAS 1.60:2643) Avail: NTIS HC A03/MF A01 CSCL 20F

ALBEDO, BIDIRECTIONAL REFLECTANCE, DESERTS, DIRECTIVITY, SOLAR POSITION, ZENITH

**N87-27315\*** National Aeronautics and Space Administration, Washington, D.C.

**EARTH RESOURCES: A CONTINUING BIBLIOGRAPHY WITH INDEXES (ISSUE 54)**

Aug. 1987 164 p  
 (NASA-SP-7041(54); NAS 1.21:7041(54)) Avail: NTIS HC A08 CSCL 05B

This bibliography lists 562 reports, articles, and other documents introduced into the NASA scientific and technical information system between April 1 and June 30, 1987. Emphasis is placed on the use of remote sensing and geophysical instrumentation in spacecraft and aircraft to survey and inventory natural resources and urban areas. Subject matter is grouped according to agriculture and forestry, environmental changes and cultural resources, geodesy and cartography, geology and mineral resources, hydrology and water management, data processing and distribution

systems, instrumentation and sensors, and economic analysis.

Author

**N87-28162\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.  
**EFFECTS OF AEROSOLS AND SURFACE SHADOWING ON BIDIRECTIONAL REFLECTANCE MEASUREMENTS OF DESERTS**

DAVID E. BOWKER and RICHARD E. DAVIS Sep. 1987 26 p (NASA-TP-2756; L-16327; NAS 1.60:2756) Avail: NTIS HC A03/MF A01 CSCL 04A

AEROSOLS, BIDIRECTIONAL REFLECTANCE, DESERTS, DUST, REMOTE SENSING, SHADOWS, SURFACE PROPERTIES

**N87-28955\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**ATLAS OF ABSORPTION LINES FROM 0 TO 17900 CM (SUP)-1**

J. H. PARK, L. S. ROTHMAN, C. P. RINSLAND, H. M. PICKETT, D. J. RICHARDSON, and J. S. NAMKUNG (ST Systems Corp., Hampton, Va.) Sep. 1987 197 p (NASA-RP-1188; L-16330; NAS 1.61:1188) Avail: NTIS HC A09/MF A01 CSCL 04A

Plots of logarithm (base 10) of absorption line strength versus wavenumber from 0 to 17900/cm(sup)-1 are shown for the 28 atmospheric gases (H<sub>2</sub>O, CO<sub>2</sub>, O<sub>3</sub>, N<sub>2</sub>O, CO, CH<sub>4</sub>, O<sub>2</sub>, NO, SO<sub>2</sub>, NO<sub>2</sub>, NH<sub>3</sub>, HNO<sub>3</sub>, OH, HF, HCl, HBr, HI, ClO, OCS, H<sub>2</sub>CO, HOCl, N<sub>2</sub>, HCN, CH<sub>3</sub>Cl, H<sub>2</sub>O<sub>2</sub>, C<sub>2</sub>H<sub>2</sub>, C<sub>2</sub>H<sub>6</sub>, PH<sub>3</sub>), which appear in the 1986 Air Force Geophysics Laboratory high-resolution transmission molecular absorption data base (HITRAN) compilation, and for O(P-3), O-18 isotopic ozone, and HO<sub>2</sub> from the 1984 JPL compilation in the 0- to 200/cm(sup)-1 region, and infrared solar CO lines at 4500 K. Also shown are plots of logarithm (base 10) of approximate infrared absorption cross sections of 11 heavy molecules versus wavenumber. The cross-section data cover 700 to 1800/cm(sup)-1 and are included as a separate data file in the 1986 HITRAN database.

Author

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### ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells; global sources of energy; geophysical conversion; and windpower.

**N87-26413\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**SPACE PHOTOVOLTAIC RESEARCH AND TECHNOLOGY 1986. HIGH EFFICIENCY, SPACE ENVIRONMENT, AND ARRAY TECHNOLOGY**

Jun. 1987 375 p Conference held in Cleveland, Ohio, 7-9 Oct. 1986

(NASA-CP-2475; E-3450; NAS 1.55:2475) Avail: NTIS HC A16/MF A01 CSCL 10B

CONFERENCES, ENERGY CONVERSION EFFICIENCY, PHOTOVOLTAIC CONVERSION, SOLAR CELLS, SPACECRAFT POWER SUPPLIES

**N87-29914\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**SPACE ELECTROCHEMICAL RESEARCH AND TECHNOLOGY (SERT)**

Sep. 1987 364 p Conference held in Cleveland, Ohio, 14-16 Apr. 1987

(NASA-CP-2484; E-3506; NAS 1.55:2484) Avail: NTIS HC A16/MF A01 CSCL 10C

ELECTRIC BATTERIES, ELECTROCATALYSTS, ELECTROCHEMISTRY, MATHEMATICAL MODELS, REGENERATIVE FUEL CELLS

## 46

### GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

**N87-11358\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**AIRBORNE LIDAR MEASUREMENTS OF EL CHICHON STRATOSPHERIC AEROSOLS, MAY 1983**

M. P. MCCORMICK and M. T. OSBORN (SASC Technologies, Inc., Hampton, Va.) Oct. 1986 91 p (NASA-RP-1172; L-16176; NAS 1.61:1172) Avail: NTIS HC A05/MF A01

An experimental survey flight to determine the spatial distribution and aerosol characteristics of the El Chichon-produced stratospheric aerosol was conducted in May 1983. The mission included several different sensors flown aboard the NASA Convair 990 at latitudes between 72 deg. and 56 deg. S. This report presents the lidar data from that flight mission. Representative profiles of lidar backscatter ratio, plots of integrated backscattering function versus latitude, and contours of backscatter mixing ratio versus altitude and latitude are given. In addition, tables containing numerical values of the backscatter ratio and backscattering function versus altitude are supplied for each profile. By May 1983, material produced by the El Chichon eruptions of late March-early April 1982 had spread throughout the latitudes covered by this mission. However, the most massive portion of the material resided north of 33 deg. N and was concentrated below 21 km. In this latitude region (33 deg. N to 72 deg. N), peak backscatter ratios at a wavelength of 0.6943 microns varied between 3.5 and 4.5, and the peak integrated backscattering function was about 18 X 10 to the -4 power/sr, corresponding to a peak optical depth calculated to be approximately 0.08. This report presents the results of this mission in a ready-to-use format for atmospheric and climatic studies.

Author

**N87-13022\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**DESCRIPTION OF DATA ON THE NIMBUS 7 LIMS MAP ARCHIVE TAPE: OZONE AND NITRIC ACID**

E. E. REMSBERG, R. J. KURZEJA, K. V. HAGGARD, J. M. RUSSELL, III, and L. L. GORDLEY Dec. 1986 73 p (NASA-TP-2625; L-16136; NAS 1.60:2625) Avail: NTIS HC A04/MF A01 CSCL 04A

INFRARED DETECTORS, KALMAN FILTERS, NIMBUS 7 SATELLITE, NITRIC ACID, OZONE, STRATOSPHERE

**N87-15528\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**FUTURE DIRECTIONS FOR H SUB X O SUB Y DETECTION**

DAVID R. CROSLLEY, ed. (SRI International Corp., Menlo Park, Calif.) and JAMES M. HOELL, ed. Dec. 1986 67 p Workshop held in Menlo Park, Calif., 12-15 Aug. 1985 (NASA-CP-2448; L-16216; NAS 1.55:2448) Avail: NTIS HC A04/MF A01 CSCL 04A

ATMOSPHERIC COMPOSITION, HYDROGEN PEROXIDE, HYDROXYL RADICALS, TROPOSPHERE, WATER

**N87-17417\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**SAGE AEROSOL MEASUREMENTS. VOLUME 3: JANUARY 1, 1981 TO NOVEMBER 18, 1981**

M. PATRICK MCCORMICK Feb. 1987 274 p (NASA-RP-1173; L-16177; NAS 1.61:1173) Avail: NTIS HC A12/MF A01 CSCL 04A

The Stratospheric Aerosol and Gas Experiment (SAGE) satellite system, launched February 18, 1979, obtained profiles of aerosol extinction at 1.00 micron and 0.45 micron ozone concentration, and nitrogen dioxide concentration. Data taken during sunset events are presented in the form of zonal and seasonal averages of



aerosol extinction of 1.00 micron and 0.45 micron, ratios of aerosol extinction to molecular extinction at 1.00 micron and ratios of aerosol extinction at 0.45 micron to aerosol extinction at 1.00 micron. Averages for 1981 are shown in tables, and in profile and contour plots (as a function of altitude and latitude). In addition, temperature data provided by NOAA for the time and location of each SAGE measurement are averaged and shown in a similar format. The stratospheric aerosol distribution for 1981 shows effects of volcanically injected material from eruptions of Ulawun, Alaid, and Pagan. Peak values of aerosol extinction at 0.45 micron and 1.00 micron were 2 to 4 times higher than typical peak values observed during near background conditions. Stratospheric aerosol optical depth values at 1.00 microns increased by a factor of about 2 from near background levels in regions of volcanic activity. During the year, these values ranged from between 0.001 and 0.006. The largest were near the location of a recent eruption. The distribution of the ratio of aerosol to molecular extinction at 1.00 microns also showed that maximum values are found in the vicinity of an eruption. These maximums varied in altitude, but remained below a height of about 25 km. No attempt has been made to give detailed explanations or interpretations of these data. The intent is to provide, in a ready-to-use visual format, representative zonal and seasonal averages of aerosol extinction data for the third calendar year of the SAGE data set to facilitate atmospheric and climatic studies.

Author

**N87-18248\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**SPACE OPPORTUNITIES FOR TROPOSPHERIC CHEMISTRY RESEARCH**

JOEL S. LEVINE, ed. Feb. 1987 92 p Workshop held in New York, N.Y., 9-13 Sep. 1985 (NASA-CP-2450; L-16250; NAS 1.55:2450) Avail: NTIS HC A05/MF A01 CSCL 04A

AEROSOLS, AIR POLLUTION, ATMOSPHERIC CHEMISTRY, ATMOSPHERIC COMPOSITION, CONFERENCES, GASES, REMOTE SENSING, TROPOSPHERE

**N87-20663\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**AIRBORNE LIDAR MEASUREMENTS OF EL CHICHON STRATOSPHERIC AEROSOLS, JANUARY 1984**

M. PATRICK MCCORMICK and M. T. OSBORN (ST Systems Corp., Hampton, Va.) Apr. 1987 49 p (NASA-RP-1175; L-16234; NAS 1.61:1175) Avail: NTIS HC A03/MF A01 CSCL 04A

A lidar-equipped NASA Electra aircraft was flown in January 1984 between the latitude of 38 and 90 deg N. One of the primary purposes of this mission was to determine the spatial distribution and aerosol characteristics of El Chichon produced stratospheric material. Lidar data from that portion of the flight mission between 38 deg N and 77 deg N is presented. Representative profiles of lidar backscatter ratio, a plot of the integral backscattering function versus latitude, and contours of backscatter mixing ratio versus altitude and latitude are given. In addition, tables containing numerical values of the backscatter ratio and backscattering function versus altitude are applied for each profile. These data clearly show that material produced by the El Chichon eruptions of late March-early April 1982 had spread throughout the latitudes covered by this mission, and that the most massive portion of the material resided north of 55 deg N and was concentrated below 17 km in a layer that peaked at 13 to 15 km. In this latitude region, peak backscatter ratios at a wavelength of 0.6943 microns were approximately 3 and the peak integrated backscattering function was about  $15 \times 10$  to the -4/sr corresponding to a peak optical depth of approximately 0.07. This report presents the results of this mission in a ready-to-use format for atmospheric and climatic studies.

Author

**N87-20665\*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

**UPPER AND MIDDLE ATMOSPHERIC DENSITY MODELING REQUIREMENTS FOR SPACECRAFT DESIGN AND OPERATIONS**

M. H. DAVIS, ed. (Universities Space Research Association, Boulder, Colo.), R. E. SMITH, ed., and D. L. JOHNSON, ed. Feb. 1987 290 p Workshop held in Huntsville, Ala., 19-21 1985 (NAS8-36400)

(NASA-CP-2460; M-548; NAS 1.55:2460) Avail: NTIS HC A13/MF A01 CSCL 04A

AEROSPACE ENVIRONMENTS, ATMOSPHERIC DENSITY, ATMOSPHERIC MODELS, SPACECRAFT DESIGN, THERMOSPHERE

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### METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

**N87-12086\*#** National Aeronautics and Space Administration. Wallops Flight Center, Wallops Island, Va.

**PRELIMINARY ESTIMATES OF RADIOSONDE THERMISTOR ERRORS**

F. J. SCHMIDLIN, J. K. LUERS (Dayton Univ., Ohio.), and P. D. HUFFMAN Washington, D.C. Sep. 1986 19 p (NASA-TP-2637; NAS 1.60:2637) Avail: NTIS HC A02/MF A01 CSCL 04B

ERROR ANALYSIS, RADIOSONDES, THERMISTORS

**N87-13043\*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

**NASA/MSFC FY-85 ATMOSPHERIC PROCESSES RESEARCH REVIEW**

W. W. VAUGHAN, comp. and F. PORTER, comp. Oct. 1985 143 p Review held in Huntsville, Ala. 7-9 May 1985 and in Columbia, Md., 8-12 Jul. 1985 (NASA-CP-2402; M-503; NAS 1.55:2402) Avail: NTIS HC A07/MF A01 CSCL 04B

ATMOSPHERIC ELECTRICITY, ATMOSPHERIC SOUNDING, DATA PROCESSING, DOPPLER RADAR, GEOPHYSICS, MESOSCALE PHENOMENA, OPTICAL RADAR, SATELLITE IMAGERY, THUNDERSTORMS, WIND (METEOROLOGY)

**N87-20701\*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**ON REQUIREMENTS FOR A SATELLITE MISSION TO MEASURE TROPICAL RAINFALL**

OTTO W. THIELE, ed. Apr. 1987 67 p (NASA-RP-1183; NAS 1.61:1183) Avail: NTIS HC A04/MF A01 CSCL 04B

Tropical rainfall data are crucial in determining the role of tropical latent heating in driving the circulation of the global atmosphere. Also, the data are particularly important for testing the realism of climate models, and their ability to simulate and predict climate accurately on the seasonal time scale. Other scientific issues such as the effects of El Nino on climate could be addressed with a reliable, extended time series of tropical rainfall observations. A passive microwave sensor is planned to provide information on the integrated column precipitation content, its areal distribution, and its intensity. An active microwave sensor (radar) will define the layer depth of the precipitation and provide information about the intensity of rain reaching the surface, the key to determining the latent heat input to the atmosphere. A visible/infrared sensor will provide very high resolution information on cloud coverage, type, and top temperatures and also serve as the link between these data and the long and virtually continuous coverage by the geosynchronous meteorological satellites. The unique combination of sensor wavelengths, coverages, and resolving capabilities

together with the low-altitude, non-Sun synchronous orbit provide a sampling capability that should yield monthly precipitation amounts to a reasonable accuracy over a 500- by 500-km grid.

Author

**N87-22341\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**ATMOSPHERIC TURBULENCE RELATIVE TO AVIATION, MISSILE, AND SPACE PROGRAMS**

DENNIS W. CAMP, ed. and WALTER FROST, ed. (FWG Associates, Inc., Tullahoma, Tenn.) Apr. 1987 257 p Workshop held in Hampton, Va., 2-4 Apr. 1986 (NASA-CP-2468; L-16296; NAS 1.55:2468) Avail: NTIS HC A12/MF A01 CSCL 04B

AIRCRAFT SAFETY, ATMOSPHERIC MODELS, ATMOSPHERIC TURBULENCE, CONFERENCES, MISSILES, SPACE PROGRAMS, WEATHER FORECASTING

**N87-26489\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**ATLAS OF WIDE-FIELD-OF-VIEW OUTGOING LONGWAVE RADIATION DERIVED FROM NIMBUS 6 EARTH RADIATION BUDGET DATA SET, JULY 1975 TO JUNE 1978**

T. DALE BESS and G. LOUIS SMITH Aug. 1987 80 p (NASA-RP-1185; L-16325; NAS 1.61:1185) Avail: NTIS HC A05/MF A01 CSCL 04B

An atlas of monthly mean outgoing longwave radiation global contour maps and associated spherical harmonic coefficients is presented. The atlas contains 36 months of continuous data from July 1975 to June 1978. The data were derived from the first Earth radiation budget experiment, which was flown on the Nimbus-6 Sun-synchronous satellite in 1975. Only the wide-field-of-view longwave measurements are cataloged in this atlas. The contour maps along with the associated sets of spherical harmonic coefficients form a valuable data set for studying different aspects of our changing climate over monthly, annual, and interannual scales in the time domain, and over regional, zonal, and global scales in the spatial domain.

Author

**N87-26491\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**CALIBRATION OF THE SPIN-SCAN OZONE IMAGER ABOARD THE DYNAMICS EXPLORER 1 SATELLITE**

WALTER E. BRESSETTE, GERALD M. KEATING, and DAVID F. YOUNG (ST Systems Corp., Hampton, Va.) Aug. 1987 44 p (NASA-TP-2723; L-16150; NAS 1.60:2723) Avail: NTIS HC A03/MF A01 CSCL 04B

ALGORITHMS, CALIBRATING, DYNAMICS EXPLORER 1 SATELLITE, OZONE, REGRESSION ANALYSIS, ULTRAVIOLET SPECTROMETERS

**N87-29996\*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**FIVE YEAR GLOBAL DATASET: NMC OPERATIONAL ANALYSES (1978 TO 1982)**

DAVID STRAUS and JOSEPH ARDIZZONE Sep. 1987 50 p Prepared in cooperation with Sigma Data Services Corp., Rockville, Md. (NASA-RP-1194; REPT-87B0273; NAS 1.61:1194) Avail: NTIS HC A03/MF A01 CSCL 04B

This document describes procedures used in assembling a five year dataset (1978 to 1982) using NMC Operational Analysis data. These procedures entailed replacing missing and unacceptable data in order to arrive at a complete dataset that is continuous in time. In addition, a subjective assessment on the integrity of all data (both preliminary and final) is presented. Documentation on tapes comprising the Five Year Global Dataset is also included.

Author

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### OCEANOGRAPHY

Includes biological, dynamic, and physical oceanography; and marine resources.

**N87-24870\*** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**ARCTIC SEA ICE, 1973-1976: SATELLITE PASSIVE-MICROWAVE OBSERVATIONS**

CLAIRE L. PARKINSON, JOSEFINO C. COMISO, H. JAY ZWALLY, DONALD J. CAVALIERI, PER GLOERSEN, and WILLIAM J. CAMPBELL (Puget Sound Univ., Tacoma, Wash.) Jan. 1987 301 p Original contains color illustrations (NASA-SP-489; NAS 1.21:489; LC-86-23876) Avail: NTIS HC A14 CSCL 08L

The Arctic region plays a key role in the climate of the earth. The sea ice cover affects the radiative balance of the earth and radically changes the fluxes of heat between the atmosphere and the ocean. The observations of the Arctic made by the Electrically Scanning Microwave Radiometer (ESMR) on board the Nimbus 5 research satellite are summarized for the period 1973 through 1976.

B.G.

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### LIFE SCIENCES (GENERAL)

**N87-20727\*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

**LIQUID DROP STABILITY FOR PROTEIN CRYSTAL GROWTH IN MICROGRAVITY**

ROBERT B. OWEN, BETH H. BROOM, ROBERT S. SNYDER, and RON DANIEL Apr. 1987 17 p (NASA-TP-2724; NAS 1.60:2724) Avail: NTIS HC A02/MF A01 CSCL 06B

CRYSTAL GROWTH, DROPS (LIQUIDS), MICROGRAVITY APPLICATIONS, PROTEIN SYNTHESIS, STABILITY

## 52

### AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

**N87-18976\*** National Aeronautics and Space Administration, Washington, D.C.

**AEROSPACE MEDICINE AND BIOLOGY: A CUMULATIVE INDEX TO THE 1986 ISSUES (SUPPLEMENT 293)**

Jan. 1987 251 p (NASA-SP-7011(293); NAS 1.21:7011(293)) Avail: NTIS HC A12 CSCL 06E

This publication is a cumulative index to the abstracts contained in the Supplements 281 through 292 of Aerospace Medicine and Biology: A Continuing Bibliography. It includes seven indexes - subject, personal author, corporate source, foreign technology, contract number, report number, and accession number. Author

**N87-30041\*** National Aeronautics and Space Administration, Washington, D.C.  
**AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 302)**  
 Oct. 1987 55 p  
 (NASA-SP-7011(302); NAS 1.21:7011(302)) Avail: HC A04 CSCL 06E

This bibliography lists 131 reports, articles, and other documents introduced into the NASA scientific and technical information system in September, 1987. Author

## 61

### COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms, and specific applications, e.g., CAD/CAM.

**N87-10720\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.  
**PROCEEDINGS OF THE 5TH ANNUAL USERS' CONFERENCE**  
 M. SZCZUR, ed. and E. HARRIS, ed. 1985 400 p Conference held at Greenbelt, Md., 4-6 Jun. 1985  
 (NASA-CP-2399; NAS 1.55:2399) Avail: NTIS HC A17/MF A01 CSCL 09B

ACCESS CONTROL, COMPUTER NETWORKS, FORMAT, IMAGE PROCESSING, ORBITAL SPACE STATIONS, SOFTWARE ENGINEERING, SOFTWARE TOOLS

**N87-19931\*#** National Aeronautics and Space Administration, Washington, D.C.  
**COMPUTER SCIENCES AND DATA SYSTEMS, VOLUME 1**  
 Mar. 1987 356 p Proceedings of a Symposium held in Williamsburg, Va., 18-20 Nov. 1986  
 (NASA-CP-2459-VOL-1; NAS 1.55:2459-VOL-1) Avail: NTIS HC A16/MF A01 CSCL 09B

ARCHITECTURE (COMPUTERS), CONCURRENT PROCESSING, CONFERENCES, DATA MANAGEMENT, DISTRIBUTED PROCESSING, EXPERT SYSTEMS, SOFTWARE ENGINEERING

**N87-19932\*#** National Aeronautics and Space Administration, Washington, D.C.  
**COMPUTER SCIENCES AND DATA SYSTEMS, VOLUME 2**  
 Mar. 1987 339 p Proceedings of a Symposium held in Williamsburg, Va., 18-20 Nov. 1986  
 (NASA-CP-2459-VOL-2; NAS 1.55:2459-VOL-2) Avail: NTIS HC A15/MF A01 CSCL 09B

CONFERENCES, DATA STORAGE, DISTRIBUTED PROCESSING, FIBER OPTICS, OPTICAL DATA PROCESSING, PARALLEL PROCESSING (COMPUTERS), VHSIC (CIRCUITS)

**N87-23156\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.  
**SIXTH ANNUAL USERS' CONFERENCE**  
 MARTHA SZCZUR, ed. and ELFRIEDA HARRIS, ed. (Science Applications Research, Lanham, Md.) Oct. 1986 228 p Conference held in Pasadena, Calif., 8-10 Oct. 1986; sponsored by JPL and NASA, Goddard Space Flight Center  
 (NASA-CP-2463; REPT-87B0176; NAS 1.55:2463) Avail: NTIS HC A11/MF A01 CSCL 09B

APPLICATIONS PROGRAMS (COMPUTERS), COMPUTER SYSTEMS PROGRAMS, CONFERENCES, IMAGE PROCESSING, INFORMATION SYSTEMS, MAN-COMPUTER INTERFACE, OPERATING SYSTEMS (COMPUTERS)

**N87-26531\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.  
**FRONTIERS OF MASSIVELY PARALLEL SCIENTIFIC COMPUTATION**

JAMES R. FISCHER, ed. Jul. 1987 293 p Symposium held in Greenbelt, Md., 24-25 Sep. 1986; sponsored by NASA Goddard Space Flight Center and Goodyear Aerospace Corp.  
 (NASA-CP-2478; REPT-87B9876; NAS 1.55:2478) Avail: NTIS HC A13/MF A01 CSCL 09B

ALGORITHMS, COMPUTER GRAPHICS, COMPUTER SYSTEMS PERFORMANCE, COMPUTERIZED SIMULATION, PARALLEL COMPUTERS, PARALLEL PROCESSING (COMPUTERS)

## 62

### COMPUTER SYSTEMS

Includes computer networks and special application computer systems.

**N87-23202\*#** National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.  
**APPLICATIONS AND REQUIREMENTS FOR REAL-TIME SIMULATORS IN GROUND-TEST FACILITIES**  
 DALE J. ARPASI and RICHARD A. BLECH Dec. 1986 26 p  
 (NASA-TP-2672; E-3189; NAS 1.60:2672) Avail: NTIS HC A03/MF A01 CSCL 09B

GROUND TESTS, REAL TIME OPERATION, SIMULATORS, TEST FACILITIES

## 64

### NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

**N87-14054\*#** National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.  
**SOME PATH-FOLLOWING TECHNIQUES FOR SOLUTION OF NONLINEAR EQUATIONS AND COMPARISON WITH PARAMETRIC DIFFERENTIATION**  
 R. L. BARGER and R. W. WALTERS (Virginia Polytechnic Inst. and State Univ., Blacksburg.) 1986 16 p  
 (NASA-TP-2654; L-16199; NAS 1.60:2654) Avail: NTIS HC A02/MF A01 CSCL 12A

COMPUTER PROGRAMMING, CRITICAL PATH METHOD, DIFFERENTIAL EQUATIONS, NONLINEAR EQUATIONS, PARAMETER IDENTIFICATION

**N87-14918\*#** National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.  
**SOLUTION OF ELLIPTIC PARTIAL DIFFERENTIAL EQUATIONS BY FAST POISSON SOLVERS USING A LOCAL RELAXATION FACTOR. 2: TWO-STEP METHOD**  
 S. C. CHANG May 1986 17 p  
 (NASA-TP-2530; E-2528-1; NAS 1.60:2530) Avail: NTIS HC A02/MF A01 CSCL 12A

ELLIPTIC DIFFERENTIAL EQUATIONS, ELLIPTIC FUNCTIONS, PARTIAL DIFFERENTIAL EQUATIONS, PROBLEM SOLVING

**N87-22441\*#** National Aeronautics and Space Administration.  
Langley Research Center, Hampton, Va.

**QUANTITATIVE ANALYSIS OF THE RECONSTRUCTION PERFORMANCE OF INTERPOLANTS**

DONALD L. LANSING and STEPHEN K. PARK (College of William and Mary, Williamsburg, Va.) May 1987 35 p  
(NASA-TP-2688; L-16164; NAS 1.60:2688) Avail: NTIS HC  
A03/MF A01 CSCL 12A

INTERPOLATION, QUANTITATIVE ANALYSIS, RECONSTRUCTION

**N87-22447\*#** National Aeronautics and Space Administration.  
Langley Research Center, Hampton, Va.

**AN ALGORITHM FOR SURFACE SMOOTHING WITH RATIONAL SPLINES**

JAMES R. SCHIESS Jun. 1987 17 p  
(NASA-TP-2708; L-16272; NAS 1.60:2708) Avail: NTIS HC  
A02/MF A01 CSCL 12A

ALGORITHMS, RATIONAL FUNCTIONS, SMOOTHING, SPLINE FUNCTIONS, SURFACE ROUGHNESS

**N87-28367\*#** National Aeronautics and Space Administration.  
Langley Research Center, Hampton, Va.

**EXPERIMENTS IN ENCODING MULTILEVEL IMAGES AS QUADTREES**

DONALD L. LANSING Sep. 1987 60 p  
(NASA-TP-2722; L-16292; NAS 1.60:2722) Avail: NTIS HC  
A04/MF A01 CSCL 12A

CODING, DATA COMPRESSION, DATA STORAGE, GRAY SCALE, IMAGE PROCESSING

## 65

### STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

**N87-23244\*#** National Aeronautics and Space Administration.  
Langley Research Center, Hampton, Va.

**DEVELOPMENT OF CONFIDENCE LIMITS BY PIVOTAL FUNCTIONS FOR ESTIMATING SOFTWARE RELIABILITY**

KELLY J. DOTSON Jun. 1987 12 p  
(NASA-TP-2709; L-16264; NAS 1.60:2709) Avail: NTIS HC  
A02/MF A01 CSCL 12A

CONFIDENCE LIMITS, FAILURE ANALYSIS, PREDICTIONS, RELIABILITY ANALYSIS, SOFTWARE ENGINEERING

**N87-27474\*#** National Aeronautics and Space Administration.  
Marshall Space Flight Center, Huntsville, Ala.

**PROBABILISTIC RISK ANALYSIS OF FLYING THE SPACE SHUTTLE WITH AND WITHOUT FUEL TURBINE DISCHARGE TEMPERATURE REDLINE PROTECTION**

LEONARD HOWELL Aug. 1987 22 p  
(NASA-TP-2759; NAS 1.60:2759) Avail: NTIS HC A02/MF A01  
CSCL 12A

ENGINE FAILURE, MATHEMATICAL MODELS, SPACE SHUTTLE MAIN ENGINE, SPACECRAFT RELIABILITY, STOCHASTIC PROCESSES, TEMPERATURE SENSORS

## 71

### ACOUSTICS

Includes sound generation, transmission, and attenuation.

**N87-14120\*#** National Aeronautics and Space Administration.  
Langley Research Center, Hampton, Va.

**EFFECTS OF BACKGROUND NOISE ON TOTAL NOISE ANNOYANCE**

K. F. WILLSHIRE Jan. 1987 59 p  
(NASA-TP-2630; L-16153; NAS 1.60:2630) Avail: NTIS HC  
A04/MF A01 CSCL 46A

BACKGROUND NOISE, EFFECTIVE PERCEIVED NOISE LEVELS, NOISE INTENSITY, NOISE POLLUTION, NOISE TOLERANCE

**N87-17479\*#** National Aeronautics and Space Administration.  
Langley Research Center, Hampton, Va.

**POWER CEPSTRUM TECHNIQUE WITH APPLICATION TO MODEL HELICOPTER ACOUSTIC DATA**

R. M. MARTIN and C. L. BURLEY Washington Jun. 1986 68 p

(NASA-TP-2586; L-16070; NAS 1.60:2586) Avail: NTIS HC  
A04/MF A01 CSCL 20A

ACOUSTIC MEASUREMENT, CEPSTRAL ANALYSIS, HELICOPTERS, MODELS, SIGNAL REFLECTION

**N87-18399\*#** National Aeronautics and Space Administration.  
Langley Research Center, Hampton, Va.

**CORRELATION OF HELICOPTER IMPULSIVE NOISE FROM BLADE-VORTEX INTERACTION WITH ROTOR MEAN INFLOW**

ANDREW B. CONNOR and R. M. MARTIN Mar. 1987 23 p  
(NASA-TP-2650; L-16145; NAS 1.60:2650) Avail: NTIS HC  
A02/MF A01 CSCL 20A

BLADE SLAP NOISE, BLADE-VORTEX INTERACTION, ROTOR BLADES (TURBOMACHINERY), VORTICES, WIND TUNNEL TESTS

**N87-20798\*#** National Aeronautics and Space Administration.  
Langley Research Center, Hampton, Va.

**EXPERIMENTAL VALIDATION OF A TWO-DIMENSIONAL SHEAR-FLOW MODEL FOR DETERMINING ACOUSTIC IMPEDANCE**

TONY L. PARROTT, WILLIE R. WATSON, and MICHAEL G. JONES (PRC Kentron, Inc., Hampton, Va.) May 1987 50 p  
(NASA-TP-2679; L-16203; NAS 1.60:2679) Avail: NTIS HC  
A03/MF A01 CSCL 20A

ACOUSTIC IMPEDANCE, MODELS, SHEAR FLOW, TWO DIMENSIONAL FLOW

**N87-24161\*#** National Aeronautics and Space Administration.  
Langley Research Center, Hampton, Va.

**ANNOYANCE RESPONSE TO SIMULATED ADVANCED TURBOPROP AIRCRAFT INTERIOR NOISE CONTAINING TONAL BEATS**

JACK D. LEATHERWOOD Jul. 1987 28 p  
(NASA-TP-2689; L-16184; NAS 1.60:2689) Avail: NTIS HC  
A03/MF A01 CSCL 20A

AIRCRAFT COMPARTMENTS, AIRCRAFT NOISE, HUMAN TOLERANCES, PSYCHOLOGICAL EFFECTS, RESPONSES

## 73

## NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

**N87-17487\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**DOUBLY DIFFERENTIAL CROSS SECTIONS FOR GALACTIC HEAVY-ION FRAGMENTATION**

FRANCIS A. CUCINOTTA (Old Dominion Univ., Norfolk, Va.), JOHN W. NORBURY, GOVIND S. KHANDELWAL, and LAWRENCE W. TOWNSEND Feb. 1987 23 p

(NASA-TP-2659; L-16187; NAS 1.60:2659) Avail: NTIS HC

A02/MF A01 CSCL 20H

COLLISION PARAMETERS, GALAXIES, HEAVY IONS, PARTICLE COLLISIONS, SCATTERING CROSS SECTIONS

**N87-24977\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**POSSIBLE COMPLEMENTARY COSMIC-RAY SYSTEMS: NUCLEI AND ANTINUCLEI**

WARREN W. BUCK, JOHN W. WILSON, LAWRENCE W. TOWNSEND, and JOHN W. NORBURY (Idaho Univ., Moscow.) Jul. 1987 47 p

(NASA-TP-2741; L-16275; NAS 1.60:2741) Avail: NTIS HC

A03/MF A01 CSCL 20H

ANTIMATTER, ANTIPARTICLES, GALACTIC COSMIC RAYS, HEAVY IONS, NUCLEI (NUCLEAR PHYSICS)

## 74

## OPTICS

Includes light phenomena; and optical devices.

**N87-13264\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**THEORY FOR COMPUTING THE FIELD SCATTERED FROM A SMOOTH INFLECTED SURFACE**

R. L. BARGER and A. K. DOMINEK 1986 23 p

(NASA-TP-2632; L-16157; NAS 1.60:2632) Avail: NTIS HC

A01/MF A01 CSCL 20F

BODIES OF REVOLUTION, ELECTROMAGNETIC RADIATION, MICROWAVES, REFLECTANCE, SURFACE PROPERTIES, WAVE SCATTERING

## 75

## PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

**N87-10764\*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**LASER-POWERED MHD GENERATORS FOR SPACE APPLICATION**

N. W. JALUFKA Oct. 1986 15 p

(NASA-TP-2621; NAS 1.60:2621) Avail: NTIS HC A02/MF A01

CSCL 20I

ENERGY CONVERSION EFFICIENCY, LASER PLASMA INTERACTIONS, MAGNETOHYDRODYNAMIC GENERATORS

**N87-14998\*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**ASYMPTOTIC ANALYSIS OF CORONA DISCHARGE FROM THIN ELECTRODES**

P. A. DURBIN Sep. 1986 7 p

(NASA-TP-2645; E-3151; NAS 1.60:2645) Avail: NTIS HC

A02/MF A01 CSCL 20I

ASYMPTOTIC METHODS, ELECTRIC CORONA, ELECTRIC DISCHARGES, ELECTRODES

## 81

## ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

**N87-20833\*** National Aeronautics and Space Administration, Washington, D.C.

**MANAGEMENT: A BIBLIOGRAPHY FOR NASA MANAGERS (SUPPLEMENT 21)**

Apr. 1987 70 p

(NASA-SP-7500(21); NAS 1.21:7500(21)) Avail: NTIS HC A04

CSCL 05A

This bibliography lists 664 reports, articles and other documents introduced into the NASA scientific and technical information system in 1986. Items are selected and grouped according to their usefulness to the manager as manager. Citations are grouped into ten subject categories: human factors and personnel issues; management theory and techniques; industrial management and manufacturing; robotics and expert systems; computers and information management; research and development; economics, costs, and markets; logistics and operations management; reliability and quality control; and legality, legislation, and policy. Author

## 82

## DOCUMENTATION AND INFORMATION SCIENCE

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography.

**N87-25023\*** National Aeronautics and Space Administration, Washington, D.C.

**NASA PATENT ABSTRACTS BIBLIOGRAPHY: A CONTINUING BIBLIOGRAPHY. SECTION 1: ABSTRACTS (SUPPLEMENT 31)**

Jul. 1987 45 p

(NASA-SP-7039(31); NAS 1.21:7039(31)) Avail: NTIS HC A03;

NTIS standing order as PB86-911100, \$11.50 domestic, \$23.00

foreign CSCL 05B

Abstracts are provided for 85 patents and patent applications entered into the NASA scientific and technical information system during the period January 1987 through June 1987. Each entry consists of a citation, an abstract, and in most cases, a key illustration selected from the patent or patent application. Author

**N87-26689\*** National Aeronautics and Space Administration, Washington, D.C.

**NASA PATENT ABSTRACTS BIBLIOGRAPHY: A CONTINUING BIBLIOGRAPHY. SECTION 2: INDEXES (SUPPLEMENT 31)**

Jul. 1987 493 p

(NASA-SP-7039(31)-SECT-2; NAS 1.21:7039(31)-SECT-2) Avail:

NTIS HC A21 CSCL 05B

A subject index is provided for over 4600 patents and patent applications for the period May 1969 through June 1987. Additional indexes list personal authors, corporate authors, contract numbers, NASA case numbers, U.S. patent class numbers, and NASA accession numbers. Author

**N87-27557\*** National Aeronautics and Space Administration, Washington, D.C.  
**NASA THESAURUS SUPPLEMENT (SUPPLEMENT 3)**  
 Jul. 1987 325 p  
 (NASA-SP-7053(SUPP-3); NAS 1.21:7053(SUPP-3)) Avail: NTIS HC A14 CSCL 05B

The four part cumulative NASA Thesaurus Supplement to the 1985 edition of the NASA Thesaurus includes Part 1, Hierarchical Listing, Part 2, Access Vocabulary, Part 3, NASA Thesaurus Definitions, and Part 4, Changes. The semiannual supplement gives complete hierarchies for new terms. Author

**N87-30218\*#** National Aeronautics and Space Administration, Washington, D.C.  
**NASA SCIENTIFIC AND TECHNICAL PUBLICATIONS: A CATALOG OF SPECIAL PUBLICATIONS, REFERENCE PUBLICATIONS, CONFERENCE PUBLICATIONS, AND TECHNICAL PAPERS, 1977-1986**

Sep. 1987 390 p  
 (NASA-SP-7063; NAS 1.21:7063) Avail: NTIS HC free as PR-655B; NASA Scientific and Technical Information Facility, P.O. Box 8757, BWI Airport, Md. 21240 HC free CSCL 05B

This catalog lists 2311 citations of all NASA Special Publications, NASA Reference Publications, NASA Conference Publications, and NASA Technical Papers that were entered into the NASA scientific and technical database during the decade 1977 through 1986. The entries are grouped by subject category. Indexes of subject terms, personal authors, and NASA report numbers are provided. Author

## 85

## URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

**N87-70425\*** National Aeronautics and Space Administration, Washington, D.C.  
**SIGNIFICANT NASA INVENTIONS. AVAILABLE FOR LICENSING IN FOREIGN COUNTRIES**  
 1977 103 p  
 (NASA-SP-7038(04); NAS 1.21:7038(04)) Avail: SOD HC \$5.00 as 003-000-00986-1; NTIS MF A01

## 88

## SPACE SCIENCES (GENERAL)

**N87-23313\*#** National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.  
**DOUBLE LAYERS IN ASTROPHYSICS**  
 ALTON C. WILLIAMS, ed. and TAUNA W. MOOREHEAD, ed. May 1987 321 p Workshop held in Huntsville, Ala., 17-19 Mar. 1986; sponsored by NASA, Washington and USRA  
 (NASA-CP-2469; M-560; NAS 1.55:2469) Avail: NTIS HC A14/MF A01 CSCL 03B

CONFERENCES, ELECTRIC FIELDS, ENERGY TRANSFER, MATHEMATICAL MODELS, PLASMA LAYERS, PLASMA PHYSICS, SPACE PLASMAS

**N87-24247\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

## ESSAYS IN SPACE SCIENCE

REUVEN RAMATY, ed., THOMAS L. CLINE, ed., and JONATHAN F. ORMES, ed. Jun. 1987 424 p Symposium held in Greenbelt, Md., 23 Apr. 1985

(NASA-CP-2464; REPT-87B0055; NAS 1.55:2464) Avail: NTIS HC A18/MF A01 CSCL 03B

ASTROPHYSICS, CONFERENCES, COSMIC RAYS, GAMMA RAY ASTRONOMY, INFRARED ASTRONOMY, X RAY ASTRONOMY

**N87-28471\*#** National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.

## CALCULATION AND ACCURACY OF ERBE SCANNER MEASUREMENT LOCATIONS

LAWRENCE H. HOFFMAN, WILLIAM L. WEAVER, and JAMES F. KIBLER Sep. 1987 34 p

(NASA-TP-2670; L-16218; NAS 1.60:2670) Avail: NTIS HC A03/MF A01 CSCL 03B

COMPUTATION, EARTH ATMOSPHERE, EARTH RADIATION BUDGET EXPERIMENT, POSITION (LOCATION), REMOTE SENSING, SCANNING

## 89

## ASTRONOMY

Includes radio, gamma-ray, and infrared astronomy; and astrometry.

**N87-14219\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

## TEN YEAR PLANETARY EPHEMERIS: 1986-1995

F. ESPENAK Nov. 1986 249 p  
 (NASA-RP-1176; NAS 1.61:1176; REPT-86B0471) Avail: NTIS HC A11/MF A01 CSCL 03A

Accurate geocentric positions are tabulated at five day intervals for the Sun, Mercury, Venus, Mars, Jupiter, Saturn, Uranus and Neptune during the ten year period 1986 through 1995. The apparent angular diameters, radial velocities, declinations and mean times of meridian transit of the seven planets and the Sun are graphically depicted for each year in the interval. Appendices are included which discuss the theory of planetary orbits and a FORTRAN program for calculating planetary ephemerides.

Author

**N87-22573\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

## INFRARED SOURCE CROSS-INDEX, FIRST EDITION

MARION SCHMITZ (Computer Sciences Corp., Beltsville, Md.), JAYLEE M. MEAD, and DANIEL Y. GEZARI Apr. 1987 323 p  
 (NASA-RP-1182; REPT-87B0058; NAS 1.61:1182) Avail: NTIS HC A14/MF A01 CSCL 03A

The Infrared Source Cross-Index is a listing of correlated infrared source names (and positions) for astronomical objects observed at 1-1000 microns. The source names have been obtained from the database of the first edition of the Catalog of Infrared Observations (CIO: NASA RP 1118), covering observations published through 1982. Additional identifications were located by correlating these names with identifications contained in other machine-readable astronomical catalogs in the NASA National Space Science Data Center (NSSDC). There are some 80,000 different source names in the Cross-Index, corresponding to over 27,000 unique infrared sources. Author

**N87-24266\*#** National Aeronautics and Space Administration, Washington, D.C.

# **STAR FORMATION IN GALAXIES**

May 1987 755 p Conference held in Pasadena, Calif., 16-19 Jun. 1986

(NASA-CP-2466; NAS 1.55:2466) Avail: NTIS HC A99/MF E03 CSCL 03A

CONFERENCES, GALACTIC STRUCTURE, GALAXIES, INFRARED ASTRONOMY, MOLECULAR CLOUDS, RADIO ASTRONOMY, STAR FORMATION, STELLAR LUMINOSITY

**N87-25906\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

# **FIFTY YEAR CANON OF SOLAR ECLIPSES: 1986 - 2035**

FRED ESPENAK Jul. 1987 272 p

(NASA-RP-1178-REV; REPT-87B0252; NAS 1.61:1178-REV)

Avail: NTIS HC A12/MF A01 CSCL 03A

A complete catalog is presented, listing the general characteristics of every solar eclipse from 1901 through 2100. To complement this catalog, a detailed set of cylindrical projection world maps shows the umbral paths of every solar eclipse over the 200 year interval. Focusing in on the next 50 years, accurate geodetic path coordinates and local circumstances for the 71 central eclipses from 1987 through 2035 are tabulated. Finally, the geodetic paths of the umbral and penumbral shadows of all 109 solar eclipses in this period are plotted on orthographic projection maps of the Earth. Appendices are included which discuss eclipse geometry, eclipse frequency and occurrence, modern eclipse prediction and time determination. Finally, code for a simple Fortran program is given to predict the occurrence and characteristics of solar eclipses. Author

## 90

### ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

**N87-30235\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

# **ATLAS OF COMET HALLEY 1910 II**

BERTRAM DONN, JUERGEN RAHE, and JOHN C. BRANDT 1986 597 p

(NASA-SP-488; NAS 1.21:488; LC-86-16341) Avail: SOD HC \$48.00 as 033-000-00991-7; NTIS MF A01 CSCL 03B

With the impending return of Halley's Comet in 1986, a major effort began to collect the material obtained at its last appearance in 1910. This material displays the evolving coma and tail phenomena, and is useful for comparison with the present quantitative studies of spectroscopic and structural phenomena. Images in the atlas are arranged in chronological order by day. Days that have multiple images with varying scale are arranged in two sequences. Photographs showing tail phenomena are first, followed by photographs obtained with longer focus instruments showing the head or near-nuclear region. Drawings of Comet Halley, made from visual observations in 1835 and 1910, also are included. B.G.

## 91

### LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

**N87-17598\*#** National Aeronautics and Space Administration, Goddard Inst. for Space Studies, New York, N.Y.

# **THE JOVIAN ATMOSPHERES**

MICHAEL ALLISON, ed. and LARRY D. TRAVIS, ed. Oct. 1986 129 p Conference held in New York, N.Y., 6-8 May 1985

Submitted for publication

(NASA-CP-2441; NAS 1.55:2441) Copyright Avail: NTIS HC A07/MF A01 CSCL 84B

ATMOSPHERIC CHEMISTRY, CLOUDS (METEOROLOGY), GAS DYNAMICS, GAS GIANT PLANETS, HYDROGEN, JUPITER ATMOSPHERE, NEPTUNE ATMOSPHERE, SATURN ATMOSPHERE, SPACE EXPLORATION, SYNOPTIC METEOROLOGY, THERMODYNAMICS, URANUS ATMOSPHERE

**N87-19322\*#** National Aeronautics and Space Administration, Washington, D.C.

# **STATUS AND FUTURE OF LUNAR GEOSCIENCE**

1986 63 p

(NASA-SP-484; NAS 1.21:484) Avail: SOD HC \$4.25 as 033-000-00997-6; NTIS MF A01 CSCL 03B

The Moon is of special interest among the many and diverse bodies of the solar system because it serves as a scientific baseline for understanding the terrestrial planets, its origin is closely tied to the early history of the Earth, and its proximity permits a variety of space applications such as mining and establishment of bases and colonies. Data acquisition and analysis have enabled advances to be made and the remaining questions in many fields of lunar geoscience to be identified. The status and unresolved problems of lunar science are discussed. Immediate needs, new unmanned missions, and a return to the Moon (a lunar base) are examined. B.G.

## 92

### SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

**N87-19328\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

# **ENERGETIC PHENOMENA ON THE SUN: THE SOLAR MAXIMUM MISSION FLARE WORKSHOP. PROCEEDINGS**

MUKUL KUNDU, ed. (Maryland Univ., College Park) and BRUCE WOODGATE, ed. Dec. 1986 423 p Workshop held in Greenbelt, Md., 24-28 Jan. 1983, 9-14 Jun. 1983, and 13-17 Feb. 1984

(NASA-CP-2439; NAS 1.55:2439) Avail: NTIS HC A18/MF A01 CSCL 03B

CONFERENCES, MAGNETOHYDRODYNAMIC STABILITY, SOLAR CORONA, SOLAR FLARES, SOLAR MAGNETIC FIELD, SOLAR MAXIMUM MISSION, SOLAR PHYSICS, SOLAR PROMINENCES, SUN, SUNSPOTS

**N87-20871\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

# **CORONAL AND PROMINENCE PLASMAS**

ARTHUR I. POLAND, ed. Dec. 1986 435 p Workshop held in Greenbelt, Md., 9-11 Apr. 1985 and 8-10 Apr. 1986

(NASA-CP-2442; REPT-86B0536; NAS 1.55:2442) Avail: NTIS HC A19/MF A01 CSCL 03B

CONFERENCES, MAGNETIC FIELD CONFIGURATIONS, MAGNETOHYDRODYNAMIC STABILITY, MAGNETOSTATICS, PLASMAS (PHYSICS), RADIO ASTRONOMY, SOLAR

ATMOSPHERE, SOLAR CORONA, SOLAR MAGNETIC FIELD,  
SOLAR PHYSICS, SOLAR PROMINENCES, SUN

**N87-20947\*#** National Aeronautics and Space Administration.  
Marshall Space Flight Center, Huntsville, Ala.

**STATISTICAL ASPECTS OF SOLAR FLARES**

ROBERT M. WILSON Apr. 1987 41 p  
(NASA-TP-2714; NAS 1.60:2714) Avail: NTIS HC A03/MF A01  
CSCL 03B

SOLAR FLARES, SOLAR PROMINENCES, STATISTICAL  
ANALYSIS

**N87-21785\*#** National Aeronautics and Space Administration.  
Goddard Space Flight Center, Greenbelt, Md.

**RAPID FLUCTUATIONS IN SOLAR FLARES**

BRIAN R. DENNIS, ed., LARRY E. ORWIG, ed., and ALAN L.  
KIPLINGER, ed. (Systems Applied Sciences Corp.-Technologies,  
Landover, Md.) 1986 491 p Workshop held in Lanham, Md.,  
30 Sep. - 4 Oct. 1985

(NASA-CP-2449; NAS 1.55:2449) Avail: NTIS HC A21/MF A01  
CSCL 03B

CONFERENCES, MICROWAVES, OSCILLATIONS, PLASMA  
PHYSICS, RADIO WAVES, SOLAR FLARES, X RAYS

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### SPACE RADIATION

Includes cosmic radiation; and inner and outer earth's radiation  
belts.

**N87-25984\*#** National Aeronautics and Space Administration.  
Goddard Space Flight Center, Greenbelt, Md.

**COSMIC RAY HEAVY ION LET MAPPING FOR ALUMINUM,  
SILICON, AND TISSUE TARGETS**

E. G. STASSINOPOULOS, J. M. BARTH, and T. M. JORDAN  
(EMP Consultants, Northridge, Calif.) Apr. 1987 264 p  
(NASA-RP-1180; REPT-87B0034; NAS 1.61:1180) Avail: NTIS  
HC A12/MF A01 CSCL 03B

Linear energy transfer (LET) values in aluminum, silicon, and  
tissue targets have been calculated for 31 galactic cosmic ray ion  
species in eight different units. The values are described for single  
event upset (SEU) effect assessments or radiobiological  
evaluations. The data are presented in graphical and tabular  
form. Author

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### GENERAL

**N87-24390\*#** National Aeronautics and Space Administration.  
Langley Research Center, Hampton, Va.

**ENGINEER IN CHARGE: A HISTORY OF THE LANGLEY  
AERONAUTICAL LABORATORY, 1917-1958**

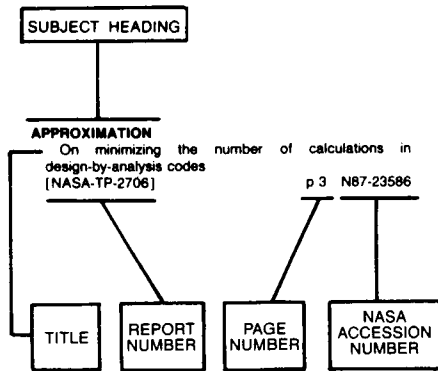
JAMES R. HANSEN (Maine Univ., Orono.) Washington, D.C.  
1986 643 p NASA History Series  
(NASW-3502)

(NASA-SP-4305; NAS 1.21:4305) Avail: SOD HC \$30.00 as  
033-000-00999-2; NTIS MF A01 CSCL 05B

A history is presented by using the most technologically  
significant research programs associated with the Langley  
Aeronautical Laboratory from 1917 to 1958 and those programs  
that, after preliminary research, seemed best to illustrate how the  
laboratory was organized, how it works, and how it cooperated  
with industry and the military. B.G.



## Typical Subject Index Listing



The subject heading is a key to the subject content of the document. The title is used to provide a description of the subject matter. When the title is insufficiently descriptive of document content, a title extension is added, separated from the title by three hyphens. The accession number and the page number are included in each entry to assist the user in locating the abstract in the abstract section. If applicable, a report number is also included as an aid in identifying the document. Under any one subject heading, the accession numbers are arranged in sequence.

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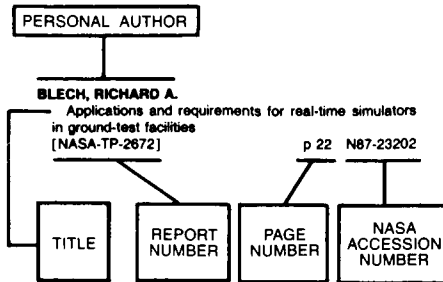
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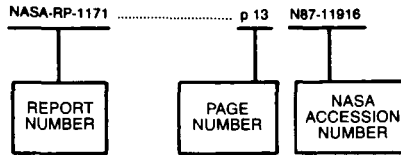
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1. Report No. NASA SP-7063(02)		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle NASA Scientific and Technical Publications: A Catalog of Special Publications, Reference Publications, Conference Publications, and Technical Papers, 1987				5. Report Date March, 1988	
				6. Performing Organization Code	
7. Author(s)				8. Performing Organization Report No.	
9. Performing Organization Name and Address Office of Management Scientific and Technical Information Division National Aeronautics and Space Administration Washington, DC 20546				10. Work Unit No.	
				11. Contract or Grant No.	
12. Sponsoring Agency Name and Address National Aeronautics and Space Administration Washington, DC 20546				13. Type of Report and Period Covered	
				14. Sponsoring Agency Code	
15. Supplementary Notes					
16. Abstract  This catalog lists 239 citations of all NASA Special Publications, NASA Reference Publications, NASA Conference Publications, and NASA Technical Papers that were entered into the NASA scientific and technical information database during accession year 1987. The entries are grouped by subject category. Indexes of subject terms, personal authors, and NASA report numbers are provided.					
17. Key Words (Suggested by Authors(s)) Catalogs (Publications)			18. Distribution Statement Unclassified - Unlimited Subject Category 82		
19. Security Classif. (of this report) Unclassified		20. Security Classif. (of this page) Unclassified		21. No. of Pages 70	
				22. Price * Free	